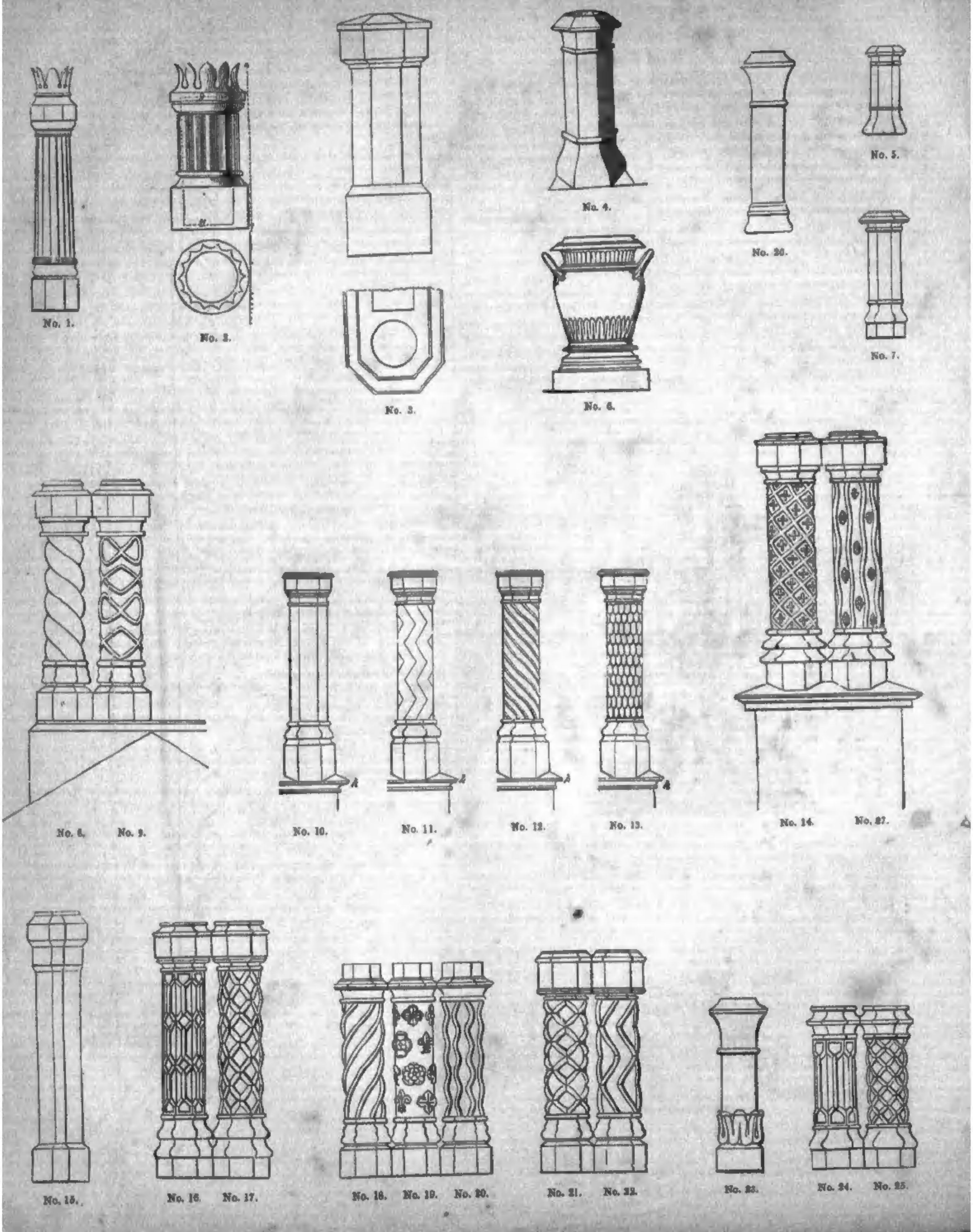
The following are selected from nearly one hundred varieties of Chimneys.



NEW AND USEFUL INVENTIONS, No. 3.

By Philotechnicos.

(With 8 pages of Wood Engravings.)

Having been prevented from continuing the series of papers which I had commenced in some of the early numbers of the Journal, and having been advised by some of my friends that notices of this kind were not only of value to the profession, as pointing out many things highly useful to them, and well deserving of encouragement, but also to the student and inventor by keeping a record of the attempts of others, I have been induced to resume my peripatetic exertions. My object being to bring before the world not only present scientific novelties, but many valuable inventions, which either lie dormant or are comparatively unknown, from their merits not having been sufficiently brought before the public; it is my intention to continue my visit to the studio, the workshop, and the manufactory, to search out and bring to light what I consider deserving of the patronage of the profession, at the same time that I rely upon their assistance to enable me satisfactorily to carry out my inquiries. Any communication therefore on these subjects, forwarded through the Editor of this Journal, I shall be happy to receive, so as to make this series of papers an interesting and valuable record of the meritorious exertions of ingenious individuals. From my present notes, I have contributed this paper, in which, if I have only been able to do justice to the labours of one, it must be remembered that it is not subjects which are wanting, but space.

AUSTIN AND SEELEY'S ARTIFICIAL STONE-WORKS, NEW ROAD, REGENT'S PARK.

The excellence of the composition, the symmetrical forms of the many elegant vases and tazzas, the well modelled and numerous architectural ornaments at this establishment claim particular attention. Those two noble vases the Borghese and Medici have been restored from the originals to their full size, and while without serious alteration they have been so managed as to pair together. The noted Warwick vase reduced to half the original size, and several others from the antique, are good specimens of the material and workmanship of this manufactory, in which may be found vases of all sizes and design, from the chaste Greek to the overwrought Maltese, many of which from their moderate cost may often be introduced with advantage.

The several fountains exhibited display great taste and ingenuity; combinations of tazzas, dolphins, shells, and foliage, are cleverly contrived, with many beautiful devices for jets d'eau, which by their introduction will give great interest to the garden or conservatory, and tend much to enliven the scenery. Tazzas in gardens may be used for gold and silver fish, and serve as reservoirs for watering the garden. Much labour might be avoided if water were laid on to pedestals placed in several parts of the garden, and furnished with stop-cocks and flexible tubes concealed in them; the tube may be furnished with jets and roses for watering the plants with greater facility, and for the sake of ornament, a vase or figure should surmount the pedestal, and render it a pleasing object. Where a fountain is desired and water scarce, it may be so constructed as to use the same water over and over again, by raising it up into a vase or reservoir by a force pump hidden in the pedestal, or should there be a running stream in the neighbourhood, a small water-wheel or hydraulic ram might be applied by which the water can be raised to almost any height. The hydraulic ram is frequently used to force a portion of the waste water back again to the reservoir, which it will do by self-action. Most of these contrivances may be seen in action, Mr. Austin having well studied this interesting branch of his business, and expended great time in perfecting it.

The architectural ornaments consist of a variety of Gothic finials, pinnacles, crosses, panels, fonts, traceries, parapets, copings, and other decorations. The commissioners for building new churches might with advantage pay a visit here, and be convinced that ornament and economy may be combined, when they see that by the introduction of artificial stone, they would be enabled to enrich their buildings and avoid that barn-like appearance of many of the modern churches. To ecclesiastical buildings where repetition of ornament is so frequent, Austin and Seeley's artificial stone is well adapted, and has been applied with great success; its appearance, although only half the cost, is nearly equal to stone, and in point of durability far surpasses the softer kinds, and it is only equalled by the best Portland. All the dressings might be of this material, while by the building being faced with patent pressed malms in lieu of the frigid looking white bricks, now frequently used, a more cheerful appearance might be obtained and some architectural character.

There are many other ornaments suitable for building purposes, such as balustrades, columns, gate piers, porticos, brackets, trusses, &c., in all styles. The chimney-shafts are of great variety, and I would here beseech the architect to turn his particular attention to this subject, and to use his utmost exertion to reform those miserable looking specimens of ugliness, chimney pots, that now too frequently figure on the tops of houses, being usually of a most common place form, and as much disconnected from the style of the building as the figure of Nelson would be from a Corinthian column. They ought to be designed for what they really are—terminations to the building—and consequently finished as a sort of capping to the chimney shaft, and have some decided connection therewith. Such the Italians generally considered them, and thus has Mr. Barry very judiciously introduced them at the Reform Club House, where the chimney shafts are surmounted by a projecting cornice supported by trusses, and form truly ornamental objects, adding to the effect of the building rather than detracting from it, as in too many cases chimney shafts and pots usually do. Thus utility is reconciled with ornament, without any attempt to disguise what all the world knows to be connected with the greatest comfort in the house.

The flat roofs, floors and steps exhibited at these works deserve inspection; the front yards have been excavated, and workshops formed below the surface of the ground, and covered with this material, the lightness and strength of which is astonishing. The terrace roofing is laid with plain tiles in three courses, and rendered on the top, to the thickness in all of about four inches, carried over by arches slightly cambered springing from small brick piers, and tied by light iron rods, which form their chord line. These flats have an immense weight upon them, and are each, as it were, in one piece, having no perceptible joint, by which they are made completely water tight, at the same time that they can be easily cleaned. It may be well to remark that many flats have been formed of cement and tiles, and afterwards condemned as not being impervious to wet, this is, however, for the most part, a mistaken notion—it is true wet frequently makes its appearance, and is often seen dripping from the ceiling, but this almost invariably is caused by condensation—particularly over stables where the vapour, arising from the horses put in warm, ascends to the ceiling, is immediately condensed and falls in large drops. This may be avoided by firring out the ceiling, or laying the flat upon joists, and lathing and plastering the underside.

Tombs and monuments, with a variety of cinereal urns, are among the other objects of art, Mr. Austin being seemingly as desirous to provide for his dead customers as for his living ones. Many of these memorials of the dead are well adapted to produce an effect in those excellent establishments, the cemeteries, which are now being formed in all parts of the neighbourhood of London. I hope the day is not far distant when that disgusting and unnatural custom of burying in towns will be entirely dispensed with, as many of the churchyards have been proved to emit a vapour destructive to animal life, and to be the cause of much disease in densely peopled neighbourhoods, they are moreover most distasteful in their appearance, having their monuments and head and foot stones jumbled up together in heedless confusion. An English church-yard which ought to be the pride of the parish, particularly of the clergy, is mostly a jumble of broken stones, stiff graceless

ledgers, and heaps of dirt, the whole in a miserably ragged condition, disgraceful to a civilized nation.

There are several other subjects, figures from the antique, among which may be found a large assembly of gods and goddesses, animals, from the colossal lion to the petty lap dog—the famous dog of Alcibiades and the Florentine boar, standing most conspicuously—also many sphinxes and animals after Egyptian and Greek authorities; sun-dials and pedestals—the globe sun-dial is particularly interesting. But for space and time many more articles might be enumerated. I must now conclude, having been somewhat lengthy in my notice of this composition, with a view of forwarding its general introduction in place of stone, where economy is desirable, as it is capable of great variety of form and use.

For the purpose of illustrating this paper, I have through the kindness of Messrs. Austin and Seeley, selected several wood engravings from their book of designs, all of which are from specimens already executed.

[We hail with pleasure the renewal of our old correspondent's interesting papers, and will gladly second him in his laudable endeavour to serve the meritorious class he so warmly advocates.]—Editor.

"WESLEYAN CENTENARY HALL AND MISSION-HOUSE."

Letters of no mean size, affixed to the large, and, since its recent modifications, handsome building, which has attracted so much of the attention of the frequenters of Bishopsgate Street, thus announce to the public the new appropriation of the heretofore well-known City of London Tavern. The street front is of course the part most embellished, and with this perhaps the best has been done that it admitted of, and certainly a noble effect is produced, notwithstanding many disadvantages; for the old front being left standing, and the new being only an encasement of it, but little room for invention was afforded. The design is a Corinthian order, of four columns and two side pilasters, on a rather high basement; the four columns being surmounted by a well-proportioned pediment. The columns, which, of course, form the chief feature, are both bold and elegant, and have a very graceful outline; some persons might prefer them without the fluting, but we are inclined to think, that plain attached shafts at that height, would look heavier and less effective. The caps are about the best we remember to have seen, the volutes have a very graceful contour, and the leaves are bold and well relieved, and the whole of the sculpture, of which there is a good proportion, is executed with skill and decision. We are glad to see, from this instance amongst others, that enriched mouldings are again coming into use. The architect, whether from necessity or choice, has preserved all the original openings, and those in the ground floor, having been arched, are so still. This, though it gives the basement a character not quite in accordance with the Greek order above, yet produces a playfulness of line that, in our mind, greatly mitigates the defect, which, to the sticklers for antique precedent, will no doubt be serious; whilst, to another class, in which we may include ourselves, the adoption of the Greek, instead of the Roman or Italian style, will be a still greater offence. For we doubt if the delicacy of Grecian architecture can ever be made to accord with our climate and materials. The columns are somewhat close for their size, and the window dressings are consequently cramped; but this is rather the fault of the old building than of the new, and to the same cause it may be attributed that the parts are in better proportion than the whole. The breadth of effect would have been greatly increased by substituting columns for the two pilasters at the sides, but we presume they would have projected too far beyond the adjoining houses: a difficulty that must always occur in the streets of London, where houses jostle each other like persons in a crowd. With allowance for these defects, we should not do justice to the author (Mr. Pocock, architect,) if we did not state our honest opinion, that without attempting novelties, he has done the most his circumstances and style admitted.

The ceiling of the loggia is panelled, and supported by four Doric columns fluted two thirds down. The rest of the interior, though handsome and substantial, is as plain in its architecture as at all accords with the magnitude of the structure and the elegance of the façade.

The general idea of the plan is perhaps the best part of the whole. Directly opposite the entrance gates of the loggia are the doors of the vestibule, and opposite these the doors of the hall, where a handsome flight of stone steps, with ornamental iron balusters, conduct to the corridor running straight forward, by the foot of an elegant circular staircase, to the anteroom of the secretary's office, so that the door of this anteroom is at the end of an avenue which continues in a straight line from it to the front entrance, each being visible from the other at a distance of more than a hundred feet. Rooms for other officers are provided directly over these, and are approached by the circular staircase before mentioned. Spacious offices for the transaction of the greater part of the business, are provided on each side of the outer hall, while those functionaries who require greater quiet, are provided for at the back part of the building. The flight of steps first mentioned, with the return flights leading to the Committee Room and the Library on the one pair of the front, occupy the lower part of a large covered area, from which light is obtained for the several apartments around. The workmen were still employed in the old Ball room when we were there, but, we understood, only in repairing and cleaning it, as it is to undergo no alterations, but to be fitted up with a platform and benches, and to be called "The Centenary Hall."

EPISODES OF PLAN.

(Continued from page 109.)

Whether intended for sideboard alcove, or other specific purpose, Recesses may be divided into *Simple* and *Compound*; and even those belonging to the first class admit of very great variety, exclusively of that which arises from embellishment. In their *plan*, for instance, they may be rectangular, or curved (and if curved either segmental or semicircular), or polygonal. In their *elevation*, towards the room, they may be arched or otherwise, with or without columns, &c. In *section*, they may be of the same height as the room itself; or *depressed* (that is lower); or *raised* (loftier); and if arched, in elevation, and curved or polygonal in plan may be covered by a *conch* or semidome. Neither is this all, since even this class may be subdivided into *Blind* and *Light* recesses. In the latter case various picturesque effects may be obtained according to the mode in which the light is admitted, which, however, should be so managed that the windows themselves are not visible, or else the recess assumes a different character, and becomes only a bay-window of the usual description, except it be that the window itself would not occupy the whole of it.

No instances occur to our recollection to which we can here refer at once as exemplifying some few at least of the forms and arrangements just pointed out; yet if this be so far inconvenient and unfortunate, it is also a tolerable proof that scarcely any thing at all has hitherto been done or even aimed at, as regards such features in internal plan: consequently that there is novelty of interior design in store for us, if we do but choose to adopt it, and to escape from that monotonous routine, and those *quotidian* forms to which architects now confine themselves.

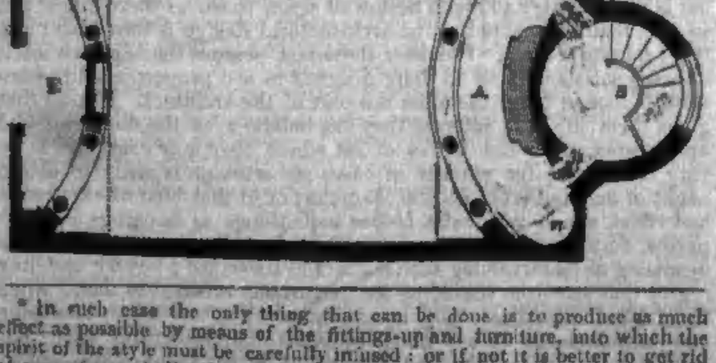
Possibly there may be instances both in regard to recesses and other features of plan that might suit our purpose, and which may deserve to be brought forward by us as examples, were we but acquainted with them. Yet if they exist at all they are not generally known: there are no engravings of them in any publications, nor are any descriptive notices of them to be met with. To say the truth, peculiarities in design, of the kind here alluded to, are almost the very last which those who give us descriptions of buildings think of speaking of at all. Which, however, is the less to be wondered at, because architects themselves are, far more frequently than not, apt to pass them over in silence, even though such parts may happen to have cost them more thought and contrivance than all the rest of a design. In fact as regards interior domestic architecture, it very seldom happens that any thing more than two extreme points are taken into consideration: while nothing is aimed at in the general *laying out* of the plan, beyond what comfort, convenience, and facility of communication require,—nor is there always so much bestowed upon these as there might be; so also nothing amounting to architectural design is introduced into the separate rooms. Provided these last possess the negative merit of being satisfactory as to their dimensions and proportions, little besides is looked to for them, on the part of the architect. For all that gives them life and interest they are indebted to the decorator and upholsterer, or to the works of art which they may contain. In by very far the greater number of cases no attempt is made to obtain aught of decided architectural character, or of that kind of expression and effect, which may exist before such things as hangings and draperies, furniture and pictures are added. We are very far from despising or undervaluing such matters as these last; yet we certainly regret that attention should be too exclusively confined to them, when they are of subordinate importance, inasmuch as they admit of change and improvement at any time, whereas if architectural effect has been disregarded in the first instance, it is not always easy—sometimes scarcely possible to supply it afterwards, without considerably

altering the building itself, and breaking up the original plan. On this account therefore it is highly important that the design should be carefully considered and strictly scrutinized in order to ascertain whether besides being satisfactory as regards convenience, and the required accommodation, it also provides a good deal of architectural effect throughout the various parts of it. Undoubtedly the present system has its conveniences: it spares a great deal of trouble—that is, of study and thought to the architect; but then it also cuts off the opportunity of displaying talent and invention upon a class of subjects, where, if allowed to be exercised, they would have free scope.

One obvious source of variety in plan, is to break the sameness of the quadrangular forms of rooms, by some kind of alcove or deep recess, constituting a distinct compartment, and further conveying the idea of extension, so much space being apparently added to what would else be the limits of the room, even although it should in fact be purposely taken from it in making the plan. Independently of all other effect such parts are almost sure to produce a good deal of pictorial expression in the ensemble of an apartment, by the effect of light and shade attending them. They may also be made to contribute very much to the air of habitableness and comfort; as many articles of furniture, or for mere ornament, may be arranged within such embayed compartments without at all crowding up or interfering with the rest of a room. Cabinets, stands for bijouterie, book-cases, ottomans, flower-stands, and other things of that kind, may there be tastefully disposed, so as to be at hand, and so as to form a striking and pleasing group of objects, and produce a certain degree of contrast as it were: not that contrast is indispensable, or indeed, in every case, adviseable. How far it is so, or the contrary, must depend upon the circumstances of the individual design, which cannot be prejudged according to any general rules, or directions.

Much may be made of an alcove or deeply embayed recess in a room, let the style of architecture adopted be what it may; and in any application of the Gothic something of the kind becomes requisite, in order to give character, particularly in a mere four-sided room, without either bay-window or any breaks in the walls.* In a room of the kind already built, or where the plan itself will not admit of a recess being formed, without interfering with some other room, or else occasioning some other difficulty, the appearance at least may be obtained by sinking a shallow arch-headed compartment on one of the sides, and decorating it with panelling and tracery filled in with pieces of mirror, so as to resemble an open-work screen. There is another point as regards Alcoves and Recesses, not yet mentioned, but which deserves to be considered, although it is one that does not admit of any positive instructions respecting it being laid down. We mean the relative size of the alcove in comparison with that of the room itself, and also the size of the opening which unites them. Independently of every thing else, here alone almost endless diversity may take place. Much also will depend upon the situation of such a recess, and whether there be only a single one, or more in the same apartment.

For want of positive examples, much of what we have hitherto said, may have been thought vague and obscure, and so far—if not otherwise—unsatisfactory. We now proceed, therefore, to give, as one of our Episodes, a plan for a Dining Room, having a rather spacious sideboard-alcove, communicating with which is a staircase exclusively for the attendants, and for serving up dinner;—the convenience of which is so obvious, that it is unnecessary to point it out.



* In such case the only thing that can be done is to produce as much effect as possible by means of the fittings-up and furniture, into which the spirit of the style must be carefully infused: or if not it is better to get rid at once of every indication of the style in such a room, concealing the upper part of the windows, as much as possible by draperies, should there be arched compartments of any kind in the heads of those apertures.

It will be evident at first sight that we do not offer this as one of the simplest arrangements of the kind, because it may in some respect be termed rather complex, and is, besides, very remarkable—some will, doubtless, say exceedingly capricious—for the form given to the ends of the room, those elevations being not only curved, but convex in plan. Should it be asked of us why we have chosen to bring forward so very unusual a circumstance, such question ought to suggest its own answer. Whether such novelty in the plan be judicious,—whether concave instead of convex ends would not be greatly better, is what the reader must determine for himself. But as it was our intention to give an instance of an alcove curved convexly towards the room, it is pretty evident that by making it otherwise than it is, we should have defeated our purpose.

Of the effect attending such peculiarity in the design, most of our readers, we presume, will have no difficulty—in judging from the plan,—that is as far as plan alone is concerned, independently of the mode in which it may be filled up. We ourselves are persuaded the effect would be pleasing, as well as strikingly novel. Owing to its colonnade being curved convexly, both that and the Alcove, A, itself, are brought forward more conspicuously. The opposite end of the room is similar in its general elevation, except that the middle intercolumn is filled up by a pier containing the fire-place, whereby the space E, or entrance alcove, serves as a kind of lobby (though not an enclosed one) to the room, and the chimney pier as a screen before the door, facing which last, there might be a blank door filled with a mirror, so as to give the effect of greater space on first entering. In this case the Dining-room is supposed to communicate immediately with the vestibule, consequently some kind of screen, (where one can be obtained, that shall rather aid than at all prejudice the architecture of the apartment) is desirable. But should the Dining-room be preceded by an Ante-room, it then becomes a question whether it would not be adviseable to alter that part of the plan, placing the chimney-piece opposite the window, and making the colonnade at E precisely similar to that at A. Owing to their bowing out towards the room, those colonnades or end elevations, certainly abridge it in some degree, yet not at all more than the plan will very well bear. While the space itself is in some measure reduced, the appearance of spaciousness is kept up. It is true such loss of space as is here occasioned at the angles of the room, can very seldom be afforded; but then, neither do we recommend a plan of the kind where it would be quite out of character with the rest of the house.

With respect to the alcove A, we have little to remark, except that the doors are so placed that when opened by the servants nothing can be seen of the staircase S. Should the sideboard *s* be insufficient, there might also be lesser ones in the two recesses *n n*, which if not required for that purpose, might have candelabra placed in them. Without at all altering the lower part or floor plan, an entirely different idea might be adopted for the upper portion at about the height of seven or eight feet, breaking through the wall above the sideboard *s*, so as to admit a view into the circular space over S, which would then become a small rotunda or upper recess, seen beyond the other. In such case there would of course be a ceiling between it and the staircase beneath. This recess would be domed, and have an eye or skylight, which should be filled with warm-tinted glass, so as to diffuse a sunny glow both over that upper recess and the alcove itself, and thereby greatly enhance the effect of the whole of that compartment as seen through the columns. The same effect might be preserved of an evening (before which a dining-room, if reserved exclusively for the purpose of one, is seldom used) by lighting it with gas on the outside of the skylight. We will further suppose this recess to be occupied by a statue (a mere cast) placed in the centre, and elevated upon a pedestal of such height that the whole of the figure would be visible from the middle of the room, if not nearer. An elevated recess of this description, might be made to answer the purpose of a music gallery, when one is required. We need not enter into further explanation or remark, as we have said enough to show what variations this plan admits of, accordingly as the section raised upon it is treated.

By no means do we pretend to say that the above Episode can be introduced into every or any plan; most certainly not. It seems best adapted for the rear of a house, in continuation of the ground floor; and supposing it so situated, and to have no other room above it, the apartment could be lighted by a lantern: that however must depend upon circumstances of locality, and whether sufficient light could be obtained from a side window according to the plan.

(To be continued.)

ON THE ARCHITECTURE OF WISBY IN THE ISLAND OF GOTHLAND, IN THE BALTIC SEA.

By JOHN WHITE, Esq., Architect.

Read at the Royal Institute of British Architects; March 8, 1841.

THE perusal of the passages in Mr. Laing's Tour in Sweden which relate to the architecture of the city of Wisby,* have induced me to make the following observations as to the origin of that mode of the construction of edifices commonly called Gothic, and to consider the existing remains of that city, for which purpose I have availed myself of some northern connexions in obtaining some further information beyond what is already before the British Institute, and feeling that Mr. Laing has much advanced the knowledge of architectural antiquity by having recommended to the attention of the public, these very early, if not the earliest, examples of Gothic construction, I submit the following remarks.

The well known observation of Sir Christopher Wren (Parentalia, page 306,) "that what we now vulgarly call the Gothic, ought properly and truly to be named the Saracenic architecture refined by the Christians, which first of all began in the East after the fall of the Greek empire, by the prodigious success of those people that adhered to Mahomet's doctrine, who out of zeal to their religion, built mosques, caravansaras and sepulchres wherever they came," is to be opposed by examining the structures of the 11th century in those parts of Europe, especially the northern, where the Saracens never came, and this I trust will be manifest, independently of other proofs, from the examination of the architecture of the remains of those churches of Wisby so referred to by Mr. Laing, which are herewith communicated so far as the drawings of them are published.

The birth of Mahomet was in the year 569, and the conquests of the Saracens followed with rapidity the commencement of the 7th century, when the Saxon style of building is supposed to have been, in the northern portion of Europe at least, the prevailing form; of this, however, in England, we have few examples; Stukeley Church. in Buckinghamshire, has been quoted by most writers as the most ancient and perfect example of the pure Saxon; it has certainly nothing Saracenic about it, excepting that all the arches are of a circular character, in common with the Roman and Saracenic, whereas what is denominated the gothic arch is universally of two or more centres describing portions of circles meeting at a point.

It may, perhaps, assist the inquiry to refer to the periods of the northern irruptions and conquests, which are as follow:

Their power in Italy, England, &c.	Began A.D.	Ended A.D.
Goths of Scandinavia	250	382
Saxons	366	not ended
Ostro Goths	400	568
Visi Goths	462	711
Lombards	570	774
Danes	787	1060
Normans	1016	not ended

The buildings at Wisby are admitted to have been constructed at the following periods:

11TH CENTURY. CHURCHES.	A.D.	12TH CENTURY. CHURCHES.	A.D.
All Saints	1030	St. Hans	1130
Holy Ghost	1046	St. Catherine	1160
St. Lawrence	1046	St. Gertrude	1167
St. Drotten	1086	St. Maria	1190
St. Peter	1086		
St. Michael	1090		
St. Nicholas	1097		

Of the Christian religion the following orders were founded:

	A.D.
Knights Hospitalers	1100
Augustine Canons	1105
Cistertians	1128
Knights Templars	1146

The following extracts from Grose's Antiquities may further elucidate the subject. See preface, page 63.

(Stowe's words on the Cathedral of London.)

"In the year 1087 the church of Saint Paul's (in London) was burnt with fire, and therewith most part of the city, Mauricius, then Bishop, began therefore the new foundations of a new church of St. Paul, a work that men of that time judged would never have been finished, it was then so wonderful for length and breadth, as also the same were builded upon arches, or vaults of stone, for defence of fire, which was a manner of work before that time unknown to the people of this nation, and then brought from France, and the stone was fetched from Caen, in Normandy, &c.

This, doubtless, is that new kind of architecture the continuer of Bede (whose words Malmsbury hath taken up) intends, when, speaking of the Norman income, he saith, "You may observe every where, in villages, churches, and in cities and villages, monasteries, erected with a new kind of architecture."

And again, speaking doubtfully of the age of the eastern part of the choir of Canterbury, he adds, "I dare constantly and confidently deny it to be elder than the Norman conquest, because of the building it upon arches, a form of architecture, though in use with and among the Romans long before, yet, after their departure, not used here in England, till the Normans brought it over with them from France. (Somner's Antiquities of Canterbury.)"

Grose further observes, page 65, (on Saxon architecture):

"This was the style of building practised all over Europe; and it continued to be used by the Normans after their arrival here, till the introduction of what is called Gothic, which was not till about the end of the reign of Henry the First, so that there seems little or no grounds for the distinction between the Saxon and Norman architecture. Indeed, it is said, that buildings of the latter were of larger dimensions, both in height and area, and they were constructed with a stone brought from Caen in Normandy, of which the workmen were particularly fond; but this was simply an alteration in the scale and materials, and not in the manner of the building. The ancient part of our cathedrals are of this early Norman work."

That building was carried on in northern countries. Jonas Ramus states, in Norwegia Antiqua et Ethnica, pages 89 and 90:

That Dronthiem was built by Olave Tryggo, who became king of Norway, A.D. 996, and Bergen was built by Olave Harald Kyrre, who completed the Cathedral of Dronthiem began by Magnus the Good and his father. Olave Harald Kyrre was buried at Dronthiem, A.D. 1093. Magnus the Good died 1047.

Roger de Montgomery built Ludlow Castle after the Norman Conquest. In the enceint there existed a circular entrance to a chapel now destroyed; this circular entrance has considerable resemblance to that of the Temple Church in London. The drawings of Ludlow Castle made in 1771, show this building, and I have made a drawing of the plan of the Wisby Churches to the same scale as that of the Temple Church, in order that their dimensions may be compared.

The period of the introduction of arches described with more than one centre, is the matter of doubt; but it can hardly be conceived that a general appellation should be used without any foundation. The Gothic monarchy in Spain was destroyed in the beginning of the 8th century by the Saracens, and of the many buildings erected by them, the arches are all of a circular character, not concentric, but of more than a semi-circular form in the void.

The Cathedral of Barcelona was begun in 1299.
That of Tarragona about - - 1200.
The monastery of Poblet, which in the interior much resembles the Wisby churches, in 1149.

It is not impossible that at the time the city of Wisby flourished, it had overland communication with India, as the troubles of the Eastern Roman Empire rendered the Mediterranean and its territories unsafe for merchandise, and as there exist in India many buildings constructed with arches even of four centres, it is possible that the Gothic arch may thence be derived, yet the Indian arches resemble more the vaultings of the Tudor style, and the most perfect of them are as late as the reign of Schah Abbas, who died in 1629.

Bishop Warburton, as quoted by Grose, says, our Norman works had a very different original from Saxon builders, who took their ideas from the buildings of the Holy Land, for when the Goths conquered Spain, they struck out a new species of architecture unknown to Greece or Rome, upon original principles, and ideas much nobler than what had given birth even to classical magnificence.

It is difficult to reconcile the style of our finest cathedrals as to their internal ranges of coupled columns with the groves of northern countries, because the fir seldom assumes, though the planted elm does, the general character of ribbed arches, but there is a natural progression of form proceeding from a repetition of the squares or round column to the octagonal, and afterwards to the coupled column, and the ribbed arches springing from the octagonal exist in the beautiful remains of St. Catherine's church at Wisby.

* Pages 301, &c. printed by Longman and Co., 1839.

In the bridge of Martorell in Spain, there are arches both of the semicircular and the pointed form. From the drawing in De la Borde's work it appears that the gothic arch (which is of 133 French feet span) is an enlargement of the water way, for the stones of two circular arches where it exists, are remaining, and exhibit the ancient work which was probably Roman. The arch is from the highest part of the soffit to the water 70 French feet. De la Borde does not say when this arch was constructed, but its magnitude renders the time of its being built a matter of interest in a question as to the origin of its form, for it would be wonderful if the Saracens had employed this mode of building, de novo, when an arch of less elevation would have better answered the purpose of a public way, and their Arabian or even Moorish origin was not likely to lead them to construct bridges of great span and height over the water way, there being little necessity for such edifices in their own country.

The first crusade was subsequent to the Council of Clermont in 1095, and it was at this council that the banner of the cross was assumed, from this assumption of the form of the Latin cross, it is probable that the plan of most of our cathedrals was adopted. None of the churches of Wisby have this shape, although there exist the repeated pillars, arches, and groins. The most ancient churches, viz. the church of Stukeley, that at Cambridge, and those of Northampton and the Temple, with the chapel at Ludlow, are totally different.

When the slender pillars were used it became necessary to employ the buttress, Mr. Samuel Ware* has successfully shown their importance, there is little appearance of their employment in the buildings of Wisby, where the pillars are of greater bulk and better calculated to support stone vaulted roofs. Stone groins certainly existed in this country at an early period, but they are confined to the crypts, and particular parts of buildings. The church of Stukeley does not exhibit any appearance of a stone arch in the main part of the building which has a wooden roof, and the Temple church has a wooden roof both over the circular part and the body, both which roofs are extremely ancient, and verging into great decay, though of the finest oak.

It may be deserving of inquiry as to where the largest and most perfect groin exists, domes are of greater antiquity, perhaps the groin of Julian's palace at Paris is that best known in this part of Europe.

I will conclude these observations by referring to the correspondence which has taken place relative to the ruins of Wisby with Major Gerss of Stockholm, by which it will appear that for the sum of 80*l.* numerous drawings can be supplied. The printed documents which were procured by my son at Stockholm, accompany this paper, together with a translation of a short history of Gothland and Wisby, the general map of the country will exhibit the situation of the island and the city, and the appendices afford various authorities of its antiquity and destruction. The lithograph plan of the city of Wisby will show the situations of the various churches and Wisby Klingwalls. Parts 1 and 2 will exhibit the buildings which have formed the subject of an intended work, but which has not gone beyond these two portions of it. It is to be hoped that it will be continued and improved upon.

January 30, 1841.

* See his work, "A Treatise on the Properties of Arches and their Abutment Piers." By Samuel Ware, Architect; London, 1809.

A FEW OBSERVATIONS ON PALLADIO.

ADDRESSED TO MR. CROKER, &c. &c.

I had hoped to have pursued a train of thought upon Palladio and his school, without startling one critic into life. Like a young and cautious mariner, I ventured not far into the open sea, because I knew critics were afloat, and because I knew them armed with every classic weapon of attack. These gentlemen, like pirates grown old in their ugly warfare, are ever to be found on the ocean of taste, whilst, with weapons sharpened upon some old ruin, and with prejudice for a war cry, they hunt for every modest searcher after the beauties of Italian art. It was for this reason, perhaps, that a partiality for Palladio seldom tempted me to an invidious comparison; I merely admired a man of original daring, and left a crowd of copyists and purloiners from Athens and Rome to interpret at their pleasure.

A sail, however, is astern, bearing up the gallant Mr. Croker, who, with spy-glass in hand, finds my rigging defective or my vessel weak. His frown is on me for my late remarks upon Campbell and Palladio. He thinks, however, because I cited no examples to support my fancies, that the guns of defence are few, and so his face changes into smiles, and his laughing caution to surrounding friends is "risum teneatis!" Now this amusing merriment in the critic amuses me, and were it not for the singular attitude of his pen at the conclusion of his letter, I should have passed from his comment with a smile. Mr. Croker's pen is made to suspend itself in threatening shape over me, to alarm and intimidate my own. Perhaps, however, it may be that the awkward little feather which Mr. Croker handles, is conscious of its intended misappropriation, and very properly shocked at the injury it is likely to inflict upon the fame of Palladio, forsakes his hand. But why does the conscious sensitive thing hang over me? Perhaps to warn me of a future attack. Mr. Croker evidently imagines his quill an object of terror, and so makes no small effort to direct me to it; but upon close inspection I perceive the little creature too harmless to disturb, and too innocent to vex.

I do admire Palladio, and if my partiality is a passion, it is a passion more like sentiment than the passion of a childish instinct. I admire Palladio for his daring and originality, for his starting up in the midst of error, when art began to grow fanciful and trifling, for his care in shunning the evils of his time, and borrowing from the beauties of the past. To test Palladio too severely by the models of antiquity, is unfair and impossible, because the modification and change necessary to the structure destroy the parallel. To test, too, Palladio by the mean experiment of subordinate variations, is ungenerous, because Roman architecture itself, imposed with its parts, much more than it charmed by its minutiæ. Palladio's great achievement, too, was the adaptation of the orders to domestic habitations, in which antiquity became subservient, and in which the whole array of detail was subsidiary. One great reason why many condemn Palladio is, because he leads them occasionally into error, and too loosely scatters his decoration. Tell them of a palace or a church designed by him, and they will tell you of an incorrect member or a broken tympanum; or speak to them of originality, and they will shout for a precedent. The source of beauty, however, may have been misunderstood, and the elements of grandeur may have been mistaken. Beauty belongs to no particular form, but to the harmony of relations blending in that form; and the same principles which adjusted the lovely outlines of antiquity, may enter into the composition of larger and grander objects. Nature supplies such innumerable varieties of beauty, such apposite changes, that I wonder *some* cannot perceive the lesson she would teach. These few remarks, arising out of Mr. Croker's observations, are all I wish at present to offer. I have not gone coolly into a digest upon Palladio, because at present I have been alluded to merely in the language of general disagreement. My reflections are therefore mere generalities, but capable, I hope, of assuming a more connected form, should the objections of a critic assume a sober shape and demand it. I do not, however, allude to Mr. Croker so much, for his reflections are generally sound and liberal; I rather fancy before me, as I write, the enemies of Palladio's style to whom he addresses his "risum teneatis," and in whose judgment nothing but the antique can please.

April 13, 1841.

FREDERICK EAST.

ENGINEERING WORKS OF THE ANCIENTS, No. 4.

The last author from whom we took was Polybius, who lived B.C. 124, the one from whom we now select, Xenophon, preceded him in time, living 400 B.C.

PERSIAN ENGINEERING.

CANALS—TIGRIS—INUNDATION—IRRIGATION.

It is in those works which treat of Persia and Egypt that we find the most information as to engineering, for the Greeks, as we have before explained, from geographical position, having no considerable rivers, were not called upon to execute those long canals and large bridges which were of vital necessity to their eastern and southern neighbours. It is therefore in Asia and Africa that we must look for the schools of engineering, of which the practice has been transmitted to us through the Greeks and the Romans. When quoting from Herodotus we before mentioned the Persian canals, and we now take from Xenophon, commander of the Greek army, what he says on the subject in his work called the Expedition of Cyrus, or Retreat of the Ten Thousand; it being our purpose not to collect what has been said on each individual subject, but to abstract from each author seriatim his separate testimony, so as to form in these essays a kind of diplomatic collection or chartulary, from which the student may derive his own materials. Of the plain of Babylon, our author says,* that in it are four canals derived from the river Tigris; being each one hundred feet in breadth,

* Book 1st.

and deep enough for barges laden with corn to sail therein; they fall into the Euphrates, and are distant from one another one parasang, having bridges over them. With regard to the origin of these canals, Arrian differs from our author, as he says that the canals which run from one to the other are derived from the Euphrates and fall into the Tigris.—Strabo and Pliny confirm this, assigning as a reason for the construction of the canals, that they are cut to receive and distribute the increase of water arising from the melting of the spring snows.

Clearchus† whilst in the same district on his retreat was much embarrassed by meeting with canals and ditches full of water. Clearchus suspected that as this was not the season to water the country, that the king had ordered the waters to be let out to impede the Greeks on their march.

About a day's march from Babylon the Greeks made in two days a march from Babylon, eight parasangs and passed two canals, one upon a bridge, the other upon seven pontoons.—Xenophon again says that these canals were derived from the Tigris, and that from them ditches were cut that ran into the country, the first broad, then narrower, which at last ended in small water courses, such as were used in Greece to water a kind of grain called panic.

To the history of these canals we shall be able to derive many contributions when we come to the works of Strabo, Pliny, and Ammianus Marcellinus. The boats of the Babylonians, as described by Herodotus, were peculiarly adapted for the navigation of these canals. At present the canals are choked up.

BRIDGES.—PASSAGE OF RIVERS AND CANALS.—PHYSCUS.

In the course of the expedition and the retreat, the Greeks came to many broad rivers, which in general they passed by fording, or by crossing on rafts; near Babylon they were able to avail themselves of the bridges of which they mention several. On one occasion coming to the Tigris‡ they found the river very deep, when a Rhodian proposed the following plan. "I shall want," said he, "two thousand leather bags—I see here great numbers of sheep, goats, oxen, and asses; if these are flayed, and their skins blown, we may easily pass the river with them.—I shall also want the girths belonging to the sumpter horses: with these I will fasten the bags to one another, and hanging stones to them, let them down into the water instead of anchors, then tie up the bags at both ends, and when they are upon the water, lay fascines upon them, and cover them with earth. Every bag will bear up two men, and the fascines and earth will prevent them from slipping." The generals considered this proposition ingenious, but were afterwards enabled to get out of their difficulties another way.

In the First Book bridges are mentioned over four canals near Babylon, each a hundred feet long; in the Second Book we have a reference to another; and in the same book we find it stated that over the river Physcus, one hundred feet broad, a bridge was placed communicating with a large and populous city called Opis. When Clearchus came among the flooded canals, he passed them by temporary bridges made of palm trees.

WALL OF MEDIA.

In the Second Book we have mention of the Wall of Media, which was built with burned bricks laid in bitumen: being twenty feet in thickness, one hundred feet in height, and as it was said twenty parasangs in length, and not far from Babylon.

CITIES AND FORTS.—WALLS.—LARISSA.—MESPILA.

Larissa or Resen is described in the Third Book as a large uninhabited city near the Tigris, anciently inhabited by the Medes, the walls of which were five-and-twenty feet in breadth, one hundred in height, and two parasangs in circuit; all built with brick, except the plinth, which was of stone, and twenty feet high. One day's march from thence the Greeks came to a large uninhabited castle near a town, called Mespila, formerly inhabited also by the Medes. The plinth of the wall was built of polished stone full of shells, being fifty feet in breadth, and as many in height. Upon this stood a brick wall fifty feet also in breadth, one hundred in height, and six parasangs in circuit.

PYRAMID OF LARISSA.

Close to the city of Larissa, says Xenophon, stands a pyramid of stone, one hundred feet square, and two hundred high, which seems to have been hollow.

GREEKS.

The observations of Xenophon as to Greek engineering we extract from his history of the affairs of Greece. In his Expedition of Cyrus however he alludes to the mole of the harbour of Byzantium, and to his forcing the Ionian Greeks to repair the roads through their cities preparatory to the march of his army.

† Book 2nd. ‡ Book 3rd.

QUARRIES OF THE PIRÆUS.

The quarries of the Piræus (Book 1st,) were in Xenophon's time wrought by Syracusan prisoners, who were confined there, and who made their escape by digging themselves a passage through the rock.

CAPTURE OF MANTINEA.

In the course of the Peloponnesian war (Book 5th) Mantinea was captured by the Spartans under Agesipolis. Besides the usual works of digging a trench, and constructing a wall, he dammed up the river, which was a large one, running through the city. The channel being thus dammed up, the water swelled above the foundations of the houses and of the city walls. The lower brickwork (being probably of raw bricks) was soon rotted by the wet, and shrank under the upper buildings, by which means the city walls cracked, and afterwards were ready to tumble. For some time they underpropped them with timber, and made use of all their art to keep them from falling. The Mantinians ultimately consented to demolish their walls.

BRIDGE OF SELLASIA.

A bridge is mentioned in the Sixth Book, at Sellasia leading to Sparta, but no description is given of it.

DOCKS OF GYTHEUM.

The docks of the Spartans (Book 6th,) were at Gytheum.

PUBLIC INNS AT ATHENS—SHOPS, &c.

In his pamphlet on the revenue of Athens, Xenophon alludes to the public inns for the use of strangers, he also recommends the building of greater numbers of shops, warehouses and exchanges for common retailers, relying upon it as a good means of revenue.

REPAIRING PUBLIC BUILDINGS BY CONTRACT.

Xenophon also in this pamphlet slightly alludes to the custom which the Greeks had of letting out the building and repair of their temples to private undertakers also mentioned by Athenæus and Herodotus, B. 5, C. 62.

DOUBLE OFFSET PLOTTING SCALE.

The Silver Medal was presented by the Society of Arts to Mr. James G. Austin, 36, Grafton Street, Gower Street, for his Offset Plotting Scale for the use of Civil Engineers and Surveyors.

The Double Offset Plotting Scale consists of two perfectly parallel graduated scales, whose distance is equal to the length of the offset scale which runs on rollers between them. The parallel scales and the offset scale are graduated to suit the views of the user. The pieces connecting the ends of the double scale are hollowed out to receive weights, armed with points to enter the paper, which hold the instrument in its place, and prevent its being shifted while in use; and from the centre of each of these connecting pieces projects an index; the points of these indices and the zero of the offset scale being always in the same straight line, which is, of course, the line from which the offsets are to be measured.

BRIDGE OF THE HOLY TRINITY.

In constructing the curve of the arches of the bridge of the Holy Trinity, according to the geometrical solution given in the last number of the Journal, I found the arcs EH, HH, make an angle at H, in consequence of the centres GI not being in a right line with the point of intersection H. This fault must have been overlooked by the author of the paper, and I take the liberty of thus troubling thee in order that the error may be corrected. May I also ask what advantage an arch upon this construction would have over a semi-elliptical one of the same versed sine (besides the simplicity of striking out the curve)?

I am, respectfully,
INEXPERTUS LOQUENDI.

Neath, 4th month, 12th day, 1841.

IRON STEAM VESSELS,

Built by Messrs. Wm. Fairbairn, and Co., of Millwall, London.

Date.	Name.	No.	Tonnage.	Horse Power.	Length on Deck.	Beam.	Depth of Hold.	Remarks.
					ft. in.	ft. in.	ft. in.	
1830	Lord Dundas, Twin boat.	1	41	18	68 0	11 6	4 0	An experimental boat, built for the Forth and Clyde Canal Company, with an engine on the locomotive principle, and light draught of water.
1831	2d Lord Dundas	2	44	20	68 0	12 0	6 6	This is the first iron boat that ever went to sea, as she made the voyage from Liverpool to Glasgow. She was built for the Forth and Clyde Canal Company with paddle-wheels on the quarters, and was employed as a coasting trader to Grangemouth, and the adjoining ports.
1831-2	Manchester	3	70	30	70 0	15 0	8 0	This was the second vessel that made a sea voyage; she was out in a severe gale in the month of February, 1832, and behaved to the admiration of all on board.
1832	Canal Boat	4	$10\frac{1}{4}$	—	60 0	6 6	4 0	
1833	La Reine de Belge	5	64	24	73 0	14 0	6 6	Built for a company at Bruges, and made the voyage from Liverpool to Ostend, and is now employed on the Scheldt.
1833	Minerva	6	108	40	98 0	15 6	7 0	Built in sections for the Lake of Zurich in Switzerland, sent in parts from Manchester to Hull, and there reconstructed, and made the voyage from Yarmouth to Rotterdam in 33 hours; steamed up the Rhine to the falls, and then taken to pieces, and carried overland; and again reconstructed on the banks of the Lake.
1834	Railway	7	164	50	110 0	18 0	8 0	Two packet boats from Selby to Hull, each drawing about 3ft. 3in. water. These boats have been plying with great success for the last 5 years upon the Humber; are still perfect, and quite free from oxidation.
1835	L'Hirondelle	8	171	60	115 0	18 0	8 0	
1836	Ludwig	9	$176\frac{44}{94}$	40	120 0	17 0	8 0	Built for the Lake of Constance, and sent out in sections. She has proved a good and fast boat. This vessel was the first built at the new premises at Millwall.
1836	Little Dreadnought	10	14	—	—	—	—	Built after the model of an East Indiaman's long boat, and has been in constant service on the river, carrying iron and other goods, and heavy castings, for 4 years, without having required the slightest repairs. On one occasion she was between two heavy ships in a tier when it broke from its moorings, and the whole of the vessels swung across the river. She was exposed without thwarts to the whole of the pressure consequent on such an accident, but was not in the slightest degree injured.
1837	Sirius	11	$249\frac{64}{94}$	70	175 0	17 1	7 10	Built for the Rhone. The engines were high pressure, with locomotive tubular boilers. Her speed was 12 miles an hour, and she drew, when light, 2ft. 6in. She was very stable, and made the passage to Marseilles partly under canvass. She was out in a very heavy gale in the Bay of Biscay, and behaved well, and on her arrival at Marseilles, was as dry as when she left the river Thames, not having made the least water, or having sprung in the least degree.
1838	Ladoga	12	$215\frac{43}{94}$	80	140 0	18 0	9 0	Swift and strong boat, used as a messenger packet by the Russian Government. Draught of water 3ft. 8in.
1838	Nevka	13	$231\frac{64}{94}$	70	150 3	18 0	9 6	Private yacht for the imperial family of Russia. Fast, strong, and substantial, and fitted with very handsome and massive cabin furnishings, schooner-rigged, and remarkably fast under canvass. She proved herself a good sea boat on her passage across the North Sea, where she encountered some severe gales, drawing 3ft. 10in. of water. For particulars see Weale's Appendix to Tredgold, parts A and B, where all the details are published.
1838	Prussian Eagle	14	$100\frac{42}{94}$	30	118 6	14 0	6 6	Built for the Upper Elbe, for the Royal Maritime Society of Berlin, with a draught of water of 28 inches. In her passage across the North Sea, she was caught in the gales of this year, and after having been out for three days she was pooped, and was ultimately lost off the coast of Ameland, having a fishing-smack in company.
1839	Concordia	15	$118\frac{44}{94}$	35	112 3	15 0	8 3	Built for the Upper Rhine, and sent out in sections. She has proved a fast and good boat; draught of water 3ft. 6in.
1839 and	Two steamers	16 17	334	80	125 0	24 0	9 0	Built for the Hon. East India Company for Bombay, and sent out in sections.
1840	Four steamers	18 to 21	334	80	125 0	24 0	9 0 and 5 0	Built for the Hon. East India Company, and sent in sections to Calcutta.
	Four accommodation boats.	22 to 25	334	—	125 0	24 0	5 0	Built for the Hon. East India Company, and sent as above.
1839	The Shell	26	$111\frac{11}{94}$	30	102 6	15 3	4 0	Steam barge for the Thames up to Oxford, passing through the locks. She has two paddle-wheels on the quarters, and goes fast with a cargo of 50 tons on a draught of 3ft. 3in.
1839	Woronzow Fradpriatie	27 28	$91\frac{9}{94}$	40	81 0	16 0	8 0	Built for the "Russian Government" for the Black Sea, for the purpose of towing lighters at the mouth of the rivers, and confined in draught of water to 3ft. 4in. They proved themselves on the passage out to be perfectly safe as sea boats, though unable to beat to windward, and in the Black Sea, they encountered the very severe gales of November and December of this year. One of them was on shore, but was lightened, and afterwards got off uninjured and proceeded, and on arriving at Sevastopol got up steam, and towed a large Russian steamer into the harbour.

Date.	Name.	No.	Tonnage.	Horse Power.	Length on Deck.	Beam.	Depth of Hold.	Remarks.
					ft. in.	ft. in.	ft. in.	
1839	Dolphin	29	106$\frac{82}{94}$	50	114 6	14 0	7 6	Built for the "Royal Maritime Society" of Berlin for the Upper Elbe, Havel and Spree to Berlin. The dimensions were regulated by some locks and bridges. She is of a very full model to save draught of water, which was limited to 2ft. 2in. She is partly used as a tug boat for towing the lighters of the country.
1840	Coquette	30	163$\frac{64}{94}$	50	150 0	15 0	8 0	Fast and strong built. She is very stable, and her speed is fully equal to 13 miles an hour. Her great length gives great accommodation for tonnage, and if speed and accommodation are considered conjointly, the results are perhaps the best yet obtained by any vessel.
1840	Iron Duke	31	109$\frac{74}{94}$	24	104 6	15 0	7 9	For the river at Demerara, as a steam-barge to carry 40 hogsheads of sugar, stowed in the holds, on a draught of 3ft. 3in. She carried this cargo at a speed of 7 miles an hour, and made the passage across the Atlantic in safety on this draught of water, being fitted with lee-boards like the Yorkshire billy buoys.
1840	Telegraph	32	206$\frac{34}{94}$	45	136 0	18 0	8 3	Built for the Weser and adjoining coasts, and gives good results, being a strong and substantial boat. The draught of water was confined to 2ft. 8in. She made the passage from Gravesend to Bremenhafen in 46 hours.
1840	Steamer	33	38$\frac{44}{94}$	14	81 0	10 0	7 6 and 4 6	Built for one of the lakes in the north of Italy, and sent out in sections.
1840	Rose Thistle	34 36	305$\frac{81}{94}$	100	153 6	20 6	11 6	Built for Sydney in every respect as sea-going steamers of the first class. They are built of a very fine model and are very fast. Their speed in the river when light was proved to be 13 miles an hour. They carry 60 tons of cargo on a draught of 7 feet of water.
1840	Steam dredge	35	54	6	65 0	14 0	4 0	Built for clearing out the Fossdyke Navigation with bucket frames to work on either side, and deepen the sides of the canal. The draught of water is 2ft. 3in., and she was towed round the coast of Lincolnshire, by a steamer without injury in the month of January.
1840	Steam ferry boat	37	25$\frac{49}{94}$	12	66 6	9 0	7 0 and 4 6	Built for Calcutta for the Hoogly, and sent out in sections, with oscillating engines. The draught of water will not exceed 18 inches when light.
1840	Canal boat	38	11$\frac{74}{94}$	—	65 0	6 0	3 2	Adapted for swift canal navigation by horses, at a speed of 10 miles an hour.
1840	Steam barge	39	31$\frac{64}{94}$		78 9	9 0	5 0	Built for an experimental barge.
1841	Yarra Yarra	40	93$\frac{49}{94}$	30	96 0	14 6	7 10	Built for Port Phillip, New South Wales, and sent out in sections all complete.
1841	Juno	41	135$\frac{49}{94}$	—	82 3	19 6	12 0	Building for the trade between London and Hull. To be rigged as a schooner.
1841	Barge	42	68$\frac{84}{94}$	48 men	60 0	16 0	4 0	Building for a floating fire-engine, and fitted with a pair of paddle-wheels. The engines are worked by cranked handles by 48 men, and arrangement is made by which they can be thrown out of gear, and the paddle-wheels can be connected and set in motion, that the barge may be easily removed to wherever it may be required.
1841	Steamer	43	254$\frac{61}{94}$	80	150 3	19 0	10 0	Building for the Royal Danish Board of Admiralty, and intended chiefly for a private yacht for the Royal family of Denmark.

The extensive use of iron steam vessels makes any information upon the subject most valuable, and we therefore feel highly indebted to Messrs. Fairbairn for their liberality in furnishing us with the preceding notes. Being engaged in this manufacture to such an extent, the results of Messrs. Fairbairn's experience are valuable, and we trust that their example will enable us to obtain from other distinguished engineers such materials as will form an important record of the progress of this branch of engineering and marine architecture.

THE BOARD OF TRADE AND THE RAILWAYS BILL.

DURING the last month a good deal of time has been lost with the Easter recess, so that the committee to whom at Sir Robert Peel's wish was referred the consideration of the powers as to railways to be given to the Board of Trade was only able to meet in the beginning of the month, when for several days they were employed in hearing witnesses for and against the plans of the Board of Trade. The evidence of Mr. Brunel against the proposed interference is said to have had great influence upon the committee, and seriously to have annoyed Mr. Labouchere, but we regret to have heard it reported that a railway engineer of great eminence had taken a very different course, and had given his support in favour of the views of the Board of Trade, and against the profession. We sincerely hope that there may have been some mis-statement with regard to this latter circumstance, as we think that such a course at the present moment is likely to be of serious prejudice to the welfare of the profession. On the motion of Lord Granville Somerset a number of reports and returns relative to railways have been published, which are quite confirmatory of the worst surmises as to the conduct and intention of the Board, and its Commissioners. It is very true that much of the arrogance of the government functionaries is directed against the companies and directors, but it must not be supposed that they are the only parties threatened. On the contrary, the military engineers (for such we regret to say all the inspectors have been) give arbitrary opinions as to the use of blocks or chairs, the form and weight of rails and chairs, the construction of locomotives and carriages, the manufacture of axles and wheels, gradients, embankments, mode of working, and whatever else they can possibly interfere with. Nor is this all, for one of the party, with the accustomed hankering for meddling with private property, proposes to excise the locomotive engineers, as Major Pringle and his colleague did the marine engineers. It is suggested that to ensure the manufacture of axles of proper materials, the engineers and the assistants should at all times have access to every part of the works, and it needs scarcely to be presumed that this suggestion will be carried by the same power being claimed for the government officers, powers which it is known are useless as a protection, and useful only as an annoyance, for if there be a disposition to act wrongly no inspection of this kind avails, instances having occurred of fraudulent rails having been made under the very eyes of engineers. In the same spirit recommendations were made that stations should be shut up, and that locomotive engines should be licensed, a recommendation, which though to short-sighted men it may appear to the advantage of engineers is clearly the reverse, for it is sure to follow that under such restrictions the supply must be reduced.

The bill itself we have described, this appendix to it is a rich commentary on its spirit, dictated by ignorance, it is pregnant with quackery and oppression, and while its recommendations would be inoperative for any useful purpose, they would be abundantly effective for mischief, a delusion on the public and an injury to the profession. In the course of the last month all the railway companies have petitioned against it, not one engineer. We have done our duty, we have called —we call on the profession to petition and oppose, and we urge them to lose no time. Let them read Colonel Thomson's report, and imagine such a man as he excising their offices and their workshops, and then if they are not aroused, we do not imagine they ever will be.

the level of the engineman's eyes; and that the point where the centre of the beam would intersect the horizon, A C, of his vision at E, should be about 700 feet from the lens. The impulse of the light would be most advantageously received at some point as near the lens as is consistent with a full effect from a flame placed in its principal focus. A more remote observer would receive the rays diluted by distance; while a nearer approach of the eye to the lens would render it necessary to adopt an ex-focal arrangement, so as to cause convergence of the rays. By the latter arrangement their divergence would be decreased, and the space covered by the light would be lessened not only in proportion to the decrease of divergence, but also to that of the cosine of the beam's inclination to the horizon. Both these circumstances would therefore combine to curtail the duration of the impression on the eye.

It may naturally be expected that I should say something regarding the duration of the impulse of the light on the eye; and upon this topic I shall, in absence of actual experiment, content myself with stating briefly the result of my calculations. If we suppose that an effective divergence of only 2° were to be obtained (and this is just one third of what is obtained from Fresnel's lens with the great lamp), I find that the light would spread itself along the horizon of the observer's eye between B and C to the distance of about 1000 yards, which, at the speed of 40 miles an hour, would be passed over in about 50 seconds, but at the ordinary railway speed of 25 miles an hour, about 80 seconds or 1⅓ minute would be required. Such a flash of light falling upon the polished parts of the engine, and upon the observer's face, would undoubtedly act as a most effective signal. If, however, it should be thought advisable to increase the duration of the impression by spreading it over a greater length of the line, this effect could be easily produced by a slight alteration of the inclination of the lens, so as to cause the line of railway to cut the refracted beam more obliquely; but I by no means expect that any such modification would be found necessary in practice. The nearness of the eye to the lens, and the brilliancy of the flash, would, I am inclined to think, more than compensate for the shortness of the impression.

I must add a few words regarding the expense of these signals, which would be made up of the cost of erecting the scaffold of carpentry, the price of the lens, and the maintenance of the light. The price of the stage I shall pass over as a matter which may vary according to the circumstances of the situation and the taste of individuals; but the cost of the great annular lens does not exceed 40*l.*; and if a smaller sized lens, which I think would be found quite sufficient for the purpose, were employed, the expense would not be more than 10*l.* The annual maintenance would consist of little more than the supply of a gas or an oil burner. The consideration of the expense, therefore, of maintaining such a system of signals at the necessary intervals on railways, is not for a moment to be set against the most remote risk of the least of all the numerous accidents, the records of which fill the public prints.

OBSERVATIONS ON THE MOTIONS OF SHINGLE BEACHES.

By Henry R. Palmer, Esq., F.R.S.*

From the Philosophical Transactions of the Royal Society:—read April 10, 1834.

The extraordinary prevalence of tempestuous weather during the last autumn having occasioned numerous disasters on our coast, the public attention was directed in an unusual degree to the imperfections of many of the harbours, and more particularly to those which are encumbered with accumulations of shingle. The access to harbours thus circumstanced is generally uncertain, and in tempestuous weather is frequently dangerous, or even impossible.

The action of the sea, which gives motion to the shingles and produces the evils complained of, has long been a subject of speculation; but I have not found that it has been systematically investigated. Indeed, the contrariety of opinions advanced upon the subject, sufficiently indicates an entire absence of that satisfactory mode of inquiry which is essential to the foundation of a safe and practical deduction.

Very little has been written upon the subject; and such facts as have been mentioned have only been referred to incidentally, or with a view to geological science. My present object is exclusively practical in its nature, and my observations have been limited to such facts as would assist in establishing certain and fixed rules for controlling the motions of the beach, so far as to enable us to preserve a clear channel through it in all seasons, and in every variety of weather; and to accumulate and preserve the shingles, where it is needful to do so.

The subject at first sight appears greatly complicated; and were it necessary to discuss minutely all the modifications arising from the variety of forms and local circumstances, it would perhaps be too much so for general description. I have, however, limited my investigation to those simple and unvarying laws to which nature always adheres; and therefore the following observations must be considered as restricted only to certain general principles, subject to a variety of modifications.

The principles which I propose to illustrate will (under similar circumstances) at all times exhibit the same phenomena, but for the sake of perspicuity I shall now only refer to the coasts of Kent and Sussex.

Section 1.

That the pebbles which compose the shingle beaches on these coasts are kept in continual motion by the action of the sea, and that their ultimate progress is in an easterly direction, are facts long known and commonly observed. The following observations are chiefly directed to the particular manner in which the motions are produced.

From a general view of the effects that I have noticed, it appears that the actions of the sea upon the loose pebbles are of three kinds: the first heaps up, or accumulates the pebbles against the shore; the second disturbs, or breaks down the accumulations previously made; and the third removes, or carries forward the pebbles in a horizontal direction.

For convenience I propose to distinguish these by the following terms, viz. the first, the accumulative action; the second, the destructive action; the third, the progressive action.

All the consequences resulting from these various actions are exclusively referrible to two causes. The one is to the current, or the motion of the general body of the water in the ebbing and flowing of the tides; the other to the waves, or that undulating motion given to the water by the action of the winds upon it; and it is of considerable importance to the present inquiry that the effects resulting from each specific cause be separately considered.

The motion of the shingles along the shore is commonly attributed to the currents, the action of the waves being considered only as a disturbing force. That such a notion is erroneous will, I apprehend, presently appear; although I have to regret that I have not had the opportunity of obtaining such satisfactory information relating to the velocities of the currents in the channel, as would have enabled me to include every form of argument upon the subject. The absence of such information has also prevented me from deciding satisfactorily as to the sources from whence the whole body of shingle is derived, which, although not necessary for the practical purposes I have in view, would have given more interest to the subject, and would have rendered the elucidation more complete. I must, therefore, for the present, be content to pursue the motions of the beach after it is found lying along or near the shore; observing only that the materials of which it is composed are those of the various strata in the vicinity of the coasts, together with the ordinary sea sand, and such small particles as may have been brought to the shore by the floods of the various rivers.

That the current is not the force which moves the pebbles along the coast, will appear from the following reasons:

1st. If it were so, the direction of the motion of the pebbles would be determined by that of the currents; but while the direction of the currents will vary with the changes of the tides, we find that the direction of the pebbles may remain unaltered; and also that the motion of the pebbles is continued where no current exists.

2nd. Although the velocities of the currents may not have been ascertained with precision, yet it is known that the velocities generally along this coast, which can possibly act on the shingles, are not sufficient to give motion to pebbles of every dimension, which are in fact carried forward.

3rd. The motion of a current will not produce that order in which the pebbles are found to lie, which order (as will be hereafter shown) may easily be distinguished as the effect of the motion of the waves only.

The direction of the waves is determined principally by the wind, the prevailing direction of which on the coasts referred to is from the westward. Every breaker is seen to drive before it the loose materials which it meets; these are thrown up the inclined plane on which they rest, and in a direction corresponding generally with that of the breaker. In all cases we observe that the finer particles descend the whole distance with the returning breaker, unless accidentally deposited in some interstices; but we perceive that the larger pebbles return only a part of the distance; and upon further inspection we

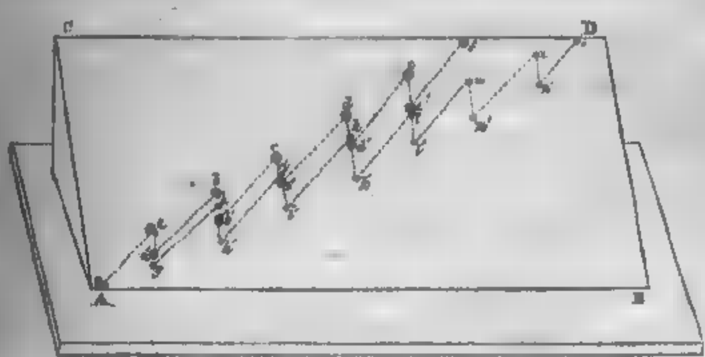
* The construction of harbours, piers, and breakwaters is likely to become of considerable importance to the engineering profession; we therefore propose to collect for publication in the Journal, such papers as have been written on the subject.

find that the distance to which each pebble returns bears some relation to its dimensions. This process is an indication of the accumulative action.

But under some circumstances, depending on the wind, it is found that pebbles of every dimension return with the breakers that forced them up the plane, and that these are accompanied also by others, which had been previously deposited, but which are in such cases disturbed by the waves; and by a continual repetition of the breakers acting in this manner, the whole of the shingle previously accumulated is immersed below the surface of the water. This process is an indication of the destructive action.

The particulars of the accumulative action, *combined with that of progression*, are explained as follows. (Fig. 1.)

Fig. 1.



Let A B C D be an inclined plane, representing that on which the loose pebbles move. Suppose the wind to blow in such a direction as to cause a wave to strike a pebble at A, in the direction of A*a*, and to the distance *a* up the plane, that point being the extent to which the force can reach. Now here the wave breaks partly into spray, and is dispersed in all directions; is partly absorbed, and descends in a shallow form, which rapidly diminishes in its depth, so that the pebble is soon left exposed, and therefore does not return the whole distance with the water, but is left at rest at *a'* being at a higher level than that from whence its motion commenced.

With the rise of the tide the striking force is also elevated; and by the repetition of the operation described through the different heights in succession, the further motion of the pebble will be represented by *a' b' b' b'*, &c., the distance in each step of its descent being something less than in that of its ascent, until it has reached the summit *f*, determined by the height of the tide. Now if we suppose a pebble of less dimensions than the former to be struck from the same point, we shall find it raised as before; but because its surface is greater in proportion to its weight, and because from its less bulk it remains longer immersed in the declining wave, it will descend further, and follow the line *a g*, &c., and will not be left at rest till it has reached *o*.

If, then, we suppose a pebble whose dimensions are less than either of the former, it will be evident that the point at which that will arrive on the highest level will be more distant still; hence it follows that the distance travelled horizontally by the pebbles during a tide will be in some proportion to their bulk, the specific gravities being the same.

(The pebbles do not in reality move in straight lines, but in a succession of curves; the straight lines are assumed here, and in other parts of this paper, to simplify the description.)

I trust it is only necessary to remark, that if the wind continue to blow in the same direction during the ebbing of the tide as through the flowing of it, the direction in which the waves will strike the shore will be nearly the same, and the progress of the pebbles will be urged by a similar action, and therefore their direction will also be the same.

In this action we observe a constant tendency to heap up and accumulate the shingles; and it is an interesting fact, that when the action has continued equally through a tide, the pebbles are left *in regular order, according to their dimensions*, the largest being uppermost, and the smallest at the bottom of the plane. I do not mean to state that all the largest are at the top, or that all the smallest are at the bottom, for it is evident that some of every size will be found at every level; but that if an equal measure (say half a peck) be taken from the different levels, the average of each specimen will exhibit in regular order the various dimensions.

The order in which the pebbles are thus found is, then, that by which the effect of the waves is distinguished from that of a current, the effect of the latter consisting only in its influence on the direction of the impinging and recoiling motions of the waves, by which the motion of the beach may in a small degree be accelerated or retarded.

Section 2.

In the illustration of that action of the sea which breaks down and removes an accumulation, I propose referring to my observations in the order in which they were made. My attention was first directed to this part of the subject in the neighbourhood of Sandgate in October last.

The accumulative action had been continued for a considerable time. The numerous groins erected near Folkstone to impede the progress of the beach, for the protection of the cliffs, had collected a bank of pebbles, which in some parts was five feet in height. The wind had so much abated as to be scarcely perceptible, but the sea had a motion denominated a *ground swell*.

The waves approached the shore nearly at right angles with it; but although in rapid succession, their forces were very moderate. These circumstances continued through five tides, by which time nearly the whole of the loose shingle had disappeared, including all that had been collected by the groins at Folkstone. The water being particularly clear, I was enabled to perceive distinctly the action upon the pebbles, and their motion downwards. I observed, that although every wave became broken and dispersed as usual, yet they followed in such rapid succession, that each wave rode over its predecessor while on its return, and thus produced a continual downward current, which carried with it the pebbles that were disturbed. That the pebbles were not removed far from the line of low water, would appear from the fact, that on the subsiding of the swell, it being succeeded by a light breeze of wind from the westward, the accumulation immediately commenced, and was restored to its former quantity by the action of four tides. I have subsequently had some favourable opportunities for making other observations on the effects produced by different rates of succession of the waves, and particularly at Dover, during the late gales, where the same actions were noticed. There I watched for an opportunity of witnessing that rate of succession which exhibited the destructive and accumulative actions in their smallest degrees; and I observed, that when ten breakers arrived in one minute, the destructive action was but just evinced; and that when only eight breakers arrived in the same period, the pebbles began to accumulate; which facts harmonized with my observations made at Sandgate and Folkstone, viz. *that the difference between the two actions was determined by the rapidity in succession of the waves upon the shores.*

In the description of the accumulative action, I have assumed the forces to be directed obliquely with the line of coast, and have therefore necessarily included the progressive motion; but it remains to be explained in what manner the shingles are carried forward while the destructive action is going on.

It is known that the action and re-action of the waves give to the whole body of the water, within a certain distance from the shore, an undulating motion. The direction of this motion, when approaching the shore, will, to a certain degree, correspond with that of the waves upon the surface, and the direction of the recoil will also be affected in like manner; therefore the pebbles that have been carried down by the destructive action are moved forward through an angular course *beneath the water*, until, by the excess of the impinging forces over those of the recoil, they are again raised by the action of the water, and deposited where the destructive action has ceased, or where, from local circumstances, it cannot occur. The circumstances which are most unfavourable to the destructive action are those which least admit of the constant downward under-current—an inlet, or narrow arm of the sea, for example. If we suppose a wave rolling through the mouth of an inlet, carrying with it a charge of shingles, it does not break as upon an inclined plane, but is dispersed in the general body of the water, which is comparatively quiescent; and there being no returning force, the shingle becomes deposited, and a bank is formed: and although the destructive process would act upon that bank if it could attain a certain height, yet the attainment of that height is prevented by the waves passing over it, and carrying with them, in succession, the shingles with which they are charged.

Section 3.

In Fig. 2 is represented a section of the beach formed along the outside of Folkstone Harbour. This section was taken with great accuracy, after the ground swell before referred to had removed most of the loose pebbles from it; so that the section may be considered as representing the plane upon which the progressive motion of the pebbles is carried on. Its slope is in the proportion of 1 to 9, nearly, and (with the exception of that part near the summit where there remained

CANDIDUS'S NOTE-BOOK.

FASCICULUS XXVI.

> "I must have liberty
> Withal, as large a charter as the winds,
> To blow on whom I please."

I. It is consolatory to learn from the Licensers' *imprimatur*, that the "Fabbriche e Disegni di Andrea Palladio" do not contain any thing contrary to *la Santa Fede Cattolica!*—they might as well have assured us that Palladio was not the heathen divinity Pallas. Yet if the collection contain nothing against the holy Catholic faith, it contains much that is calculated to stagger any reasonable man's faith in criticism, and to shock his taste mortally, if he has any taste to be shocked at all. The very best of Palladio's designs are but very mediocre indeed, and some of them absolutely barbarous. His "Palace of Reason"—as Mrs. Cresy somewhat unreasonably calls it—is just execrable; his Teatro Olimpico, just damnable. And should it be said that this is mere sweeping condemnation, amounting to nothing, I reply that it is quite as good criticism as that in which the admirers of their incomparable Andrea deal in. The *onus probandi* lies with them; and if they are utterly unable to point out any of those beauties, graces, and excellences which they place so largely to the credit of their favourite, they have certainly no right to censure their opponents for being not more explicit. Should it further be thought by some of my readers that I am continually "harping upon" Palladio, my excuse is that I feel it necessary to do so, as long as others continue to babble their praises of him. When they choose to desist from their tedious iterations, I may give over mine; but I do not see why I should fling up the game, while they continue it.

II. Though few will give me credit for blushing at any time, I frequently do blush at the drivelling silliness one meets with in architectural writers—the more than anile twaddling to which they are addicted, for even the most twaddling old woman would hardly utter such stuff, unless, she happened to be disguised—in liquour.—"Facendosi addietro di sicolo in secolo," says one, "tracing back the art from age to age, we discover it to be almost contemporaneous with the origin of the human race." Wonderful discovery, truly! But still the tailors have in point of antiquity, superiority over architects, for Breeches-making is indisputably the oldest art upon record. Surely those who write such egregious balderdash must trust largely to the stultification of their readers. Writers on the art culinary are by far a more sensible race, abstaining from such asinine absurdities in which architectural ones are apt to indulge, and for which they ought to be made to bear a fool's cap as their crest.

III. It certainly is amusing enough to observe how excessively lax and licentious are some of those grave twaddling architectural puritans who lay so much stress upon proportions, as if they were absolutely articles of faith. People of that sort are absolutely scandalized at the idea of any alteration in the shape of a base or capital, or of making an entablature at all deeper or the contrary than usual; yet they are not the least shocked at seeing an entire ordinance thrown out of proportion by disproportionably wide intercolumns; nor have they any notion of regulating the entablature according to the distance between column and column, notwithstanding that it is obvious that if those intervals be unusually wide the entablature ought to be of lighter proportions than is else given to the order; and *vice versa*. For this reason, if for no other, the portico of the National Gallery ought to have had a bolder and richer cornice, the intercolumniation being pycnostyle, and consequently the supports numerous and the openings between them narrow. For the same reason, the pediment might very properly have been made deeper. Unfortunately, however, Wilkins was one of those people, who suffer themselves to be duped—or rather, who dupe themselves by words and names. His building was to be *Greek*—that was with him a *sine qua non*, to which other considerations were to give way. A Roman entablature or cornice was out of the question, not because it would not have harmonized with the columns, but because it might have been *called* Roman, and there might have been a sort of discord, not visible indeed, but *nominal*—of course a most offensive one, for it is well known that people in general judge of architecture as they do of pictures and of wines. Tell them that a picture is by Raphael or Corregio, and though it be ever so mediocre, they fall into raptures with it, at that word of command. Call gooseberry wine by its proper name, and people turn up their noses at it, yet dignify it by the style of champagne, and it becomes delicious. Under the sanction of Inigo Jones or any other celebrated body's name, the dullest design imaginable passes for a very fine thing, where one a thousand times better by some nobody, would hardly be looked at.—I was once equally amused and enlightened at the expense of an unfortunate critic who was a professed admirer—I might say venerator of Palladio. We were turning over a portfolio of loose architectural prints and drawings, among which there happened to be one or two to which I called his attention more particularly, at the same time instancing several egregious sins in them against good taste. After assenting to all my objections, he exclaimed "they are indeed very trumpery specimens of the Italian style: they have nothing of the *sana architectura*—of the gracefulness and happy *non so che* of the divine Palladio."—"The deuce they haven't!—why is it possible that you do not recognize them as the production of your divine Palladio himself?"—He looked—what shall I say, aghast?—no he looked as if he was actually going to jump down his own throat." The next time I saw him I said—"and the divine Palladio ——," on which he cut me short by crying out, with no lack of emphasis—"Palladio be damned!"

IV. For graphic power—for consummate mastery in the art of depicting to the eye by means of the pen alone the loveliest scenery, and conjuring up the most enchanting prospects—the most fascinating visions,—I hold George Robins to be the greatest genius this or any country has ever produced. Some of his advertisements are perfect cabinet pictures, finished up with unrivalled delicacy and grace, and replete with such felicity of imagination that every object—no matter what it may be in itself, is transmuted into beauty by the potent alchemy of his pen. As viewed through the medium of his poetic imagination, a snug suburban tenement with an acre of domain attached to it, becomes—I will not say "un pezzo di cielo," nor an absolute paradise, nor a *lot* from the Elysian Fields,—but certainly a fragment of Arcadia, a pastoral landscape fit for a scene in an opera—a fairy-land encompassed by the hedge that fences it out from ordinary, every-day nature—from the mere fields, the green grass and green trees, that may be seen anywhere else. From my soul I pity the dull creatures who can see nothing more in the great G. R.'s effusions than a mere auctioneer's advertisement; and I also pity those who toss from them the half sheet of the Times, exclaiming in a tone of disappointment, it is nothing but advertisements, when advertisements are in fact the very essence of a newspaper, and the rest but mere flummery and filling-up stuff, a farrago of twaddle political, fashionable, &c., dressed up in blustering phrases.

V. "I have seen Abbotsford," says T. H. C., the clever author of "A Descriptive Tour in Scotland,"—"and I hardly know whether I do not regret that I have done so. It is not the Abbotsford of my imagination, nor of the author's description. Where is the 'romance in lime and stone'?—Dwindled to a mere story. In the exterior of the dwelling there is no congruity, no massive nobleness. In the interior there is no space for ghosts to play at hide-and-seek. If there be a few odd holes and corners, they appear rather like small remnants of a scanty cloth that has been cut into a thrifty garment, than the 'ample room and verge enough' of true antiquity. Nothing is on a great scale. Ichabod—the glory is departed. In this as in other instances, *exaggerating describers have much to answer for.*"—Mark you that, my dear George Robins!—"At their hands one demands an account of one's demolished hopes and scattered visions." If so, a good many dealers in description will have an awfully long and heavy score to settle with their readers. The best way for them to do so, would be to bring in a *per contra* account for so many manufactured visions of grandeur and beauty—not a trace of which is to be discovered in the objects themselves.

VI. A most outrageous sort of delicacy is affected by writers upon architecture who generally evade speaking of contemporary buildings, under the pretence of its being invidious to make any comments on the works of living architects. Such excuse is most flimsy; or if there be any thing in it at all, gross indeed must be the indelicacy of literary critics and reviewers who make the publications and writers of the day the subject of their comments, without the slightest sort of scruple or ceremony, and frequently with the greatest imaginable freedom. The excuse itself moreover, is not particularly complimentary to the living, inasmuch as it almost amounts to the declaration that silence on the part of criticism can alone save them and their works from the censures that honestly expressed opinion would inflict upon them. In itself, however, such silence is, I have no doubt, exceedingly convenient, for I suspect that those who avail themselves of it, have seldom any opinion of their own to express, but generally serve up to their readers second-hand *criticism*, got out of books.

A NEW SIGNAL LIGHT FOR RAILWAYS.

By Alan Stevenson, LL.B., Civil Engineer, Edinburgh.

(Read before the Society of Arts for Scotland, 22nd February, 1841.)

The numerous accidents, attended with fatal consequences, which have lately occurred on railways, have excited much alarm in the public mind, and the prevention of these casualties is unquestionably a matter of great importance. The object of this communication is, to point out one source of danger to which several of the late accidents may be attributed, and to suggest the means of its removal; and from the personal interest which all must have in the improvement of railway travelling, both as regards its speed, and, what is of much greater importance, its safety, I venture to hope that the following observations, although limited to one part of the subject, will not be found to have been unsuitably addressed to a society whose province it is to improve the useful arts.

One of the most imperfect parts of the railway system is undoubtedly the uncertainty of the night signals, and to this it is well known many of the most fatal of the accidents which have occurred must be traced. The great object of these signal lights is, to announce that the train has reached a certain point of its course, and to forewarn the engineman of his approach to a station, or the junction of a branch railway, so that the speed of the engine may be checked in proper time to prevent collision. The lights used for this purpose are generally exhibited at the place the approach to which they are intended to announce; but the distance at which light projected horizontally, may be seen by a person approaching in the line of its transmission is very variable according to the state of the atmosphere, which in our climate is subject to great and sudden changes, in regard to clearness and fog. These variations in the visibility of lights of extensive range are by no means confined within narrow limits, as experience too amply demonstrates in the case of lighthouses, whose range has been known to vary with the state of the atmosphere, from sixty miles down to two or three miles; and this evil is unhappily one of those which, in the present state of chemical and optical science, must, we fear, be pronounced irremediable. This defect, great as it is in regard to lighthouses, is, in the case of railways, materially aggravated by the excessive velocity of railway travelling. Any variation in the distance at which a signal light is first seen, must lead to great misconceptions as to the time of reaching a station, and all such misconceptions are fraught with the worst consequences, owing to the numerous sources of danger from the crossings of branch lines, the meeting of carriages on the rails, or the occurrence of other accidents, which may render a railway impassable. It is therefore obviously indispensable to safety that the signal-lights should be so constructed, that in all states of the weather they shall be constantly visible at the same point, and that this point shall be sufficiently distant from the station, the approach to which the signal is intended to announce, so as to allow ample time for checking the engine's speed before coming up to it: and upon no other grounds can the confidence of the public as to their security be reasonably based.

In the month of December last, it occurred to me in the course of conversation with my friend Mr. Errington, civil engineer, that although the variation in the visibility of lights of distant range must, according to our present knowledge, be regarded as an evil without remedy, it might still be possible, by means of some arrangement of the lights, to render *signals for railways constantly visible at the same point during every state of the atmosphere.* For this purpose, all that seems to be necessary is, to *limit* the range of the lights, and at the same time to increase their intensity in such a manner that the combination of a short range with great power may not merely render them capable of penetrating any fog however dense, but of producing, at a certain point, an effect so brilliant and striking as forcibly to arrest the engineman's attention. After considering the matter in various points of view, I came to the conclusion that the object could be best attained by placing the light considerably *in advance* of the station, the approach to which it is intended to announce, and by giving the beam such an inclination to the horizon, that its greatest power may fall upon the engineman's face, at so short a distance from the light itself, that it could not fail to be always visible at that point, even in the thickest fog.

According to the present practice, a comparatively feeble light is exhibited at the station whose position it is intended to point out, and this light, which is permitted to pierce the gloom until its power is greatly diluted by the united effects of its own divergence, and the length of its passage through a foggy medium, must necessarily be subject to constant variation of visibility with every change of the atmosphere. The change which I have to suggest, is to place a light of great power about a mile in advance of the station, and at the same time to limit its range by the depression of the resultant beam within such a distance as to ensure its being visible at all times.

The arrangement I would propose for the attainment of this object is remarkably simple, and consists in placing one of Fresnel's annular lenses, illuminated by a gas or oil burner, as may be most convenient, in a small chamber, glazed in front, and supported on a stage of carpentry of sufficient size to span the rails, and permit the train to pass under it; but the purpose might perhaps be equally well served by placing the stage at the side of the railway, and inclining the beam obliquely to the line. In order to limit the range of the lens to a short distance, and thereby to ensure the light being visible in all states of the weather at the same point, I would incline the instrument, so that the length of the trajectory from the lens to the observer's eye should not exceed about 700 feet, which falls far short of the distance at which the light of the lens would be obscured even in the thickest fog. I may remark that the inclination of the lens is too small to require any correction in the position of the flame; but this could be easily accomplished if necessary, more especially when gas is employed. In curved lines of railway the same effect might in certain cases be produced by placing the lens on a level with the observer's eye, and directing the refracted beam so as to cut the railway obliquely. In this case the limitation of range would be produced without the necessity of inclining the lens; but the principle of rendering the signal at all times effective, by combining a short range and a powerful light, is the same in both arrangements.

The advantage of this arrangement I conceive to be great, for not only would the light be at all times visible to the engineman on his arrival at the same point which, as already mentioned, is really the great object of signal lights; but it is obvious that his attention would be most effectually awakened by the contrast of suddenly passing from darkness to receive the full effect of a powerful light viewed from a short distance. One other advantage of the proposed signal light, I must observe, lies in its being peculiarly susceptible of any modification of colour, whether of a temporary or permanent kind, which the numerous and growing wants of an extended railway system may require. The alphabet of nocturnal telegraphy, wherever a distant range is required, is unhappily extremely scanty; for the practice of all Europe seems to have shown that, so far as colour is concerned, *red* and *white* are its *alpha* and *omega*; green and blue have been frequently tried; but cautious inquirers have all agreed in pronouncing them so equivocal when viewed from a distance, that they have been almost universally abandoned. These colours, however, and even much less marked varieties, although useless as distinctions for lights of distant range, are perfectly effective when viewed from short distances, as the brilliant display of an apothecary's window sufficiently proves.

I shall now add a very few words regarding what appears to me to be the chief arrangements which may, in practice, be found necessary for signal-lights on these principles; but I would not be understood as attempting to fix any thing permanently, for I am well aware that various modifications may be suggested by experiment, which I do not at present foresee in their full extent; in particular, it seems probable that the range of visibility which I have adopted in the following view of the details, falls short of what will be found quite sufficient in practice even during the thickest fogs, when a light so powerful as that which may be derived from Fresnel's lens is brought into play; and should this expectation be realized, the duration of the effect of the light, which depends on the range, might be increased beyond what I have ventured to state.

Referring to the above sketch, I would propose that the lens at L should be elevated 24 feet above the rails R R, or about 15 feet above

as is consistent with a full effect from a flame placed in its principal focus. A more remote observer would receive the rays diluted by distance; while a nearer approach of the eye to the lens would render it necessary to adopt an ex-focal arrangement, so as to cause convergence of the rays. By the latter arrangement their divergence would be decreased, and the space covered by the light would be lessened not only in proportion to the decrease of divergence, but also to that of the cosine of the beam's inclination to the horizon. Both these circumstances would therefore combine to curtail the duration of the impression on the eye.

It may naturally be expected that I should say something regarding the duration of the impulse of the light on the eye; and upon this topic I shall, in absence of actual experiment, content myself with stating briefly the result of my calculations. If we suppose that an effective divergence of only 2° were to be obtained (and this is just one third of what is obtained from Fresnel's lens with the great lamp), I find that the light would spread itself along the horizon of the observer's eye between B and C to the distance of about 1000 yards, which, at the speed of 40 miles an hour, would be passed over in about 50 seconds, but at the ordinary railway speed of 25 miles an hour, about 80 seconds or 1⅓ minute, would be required. Such a flash of light falling upon the polished parts of the engine, and upon the observer's face, would undoubtedly act as a most effective signal. If, however, it should be thought advisable to increase the duration of the impression by spreading it over a greater length of the line, this effect could be easily produced by a slight alteration of the inclination of the lens, so as to cause the line of railway to cut the refracted beam more obliquely; but I by no means expect that any such modification would be found necessary in practice. The nearness of the eye to the lens, and the brilliancy of the flash, would, I am inclined to think, more than compensate for the shortness of the impression.

I must add a few words regarding the expense of these signals, which would be made up of the cost of erecting the scaffold of carpentry, the price of the lens, and the maintenance of the light. The price of the stage I shall pass over as a matter which may vary according to the circumstances of the situation and the taste of individuals; but the cost of the great annular lens does not exceed 40*l.*; and if a smaller sized lens, which I think would be found quite sufficient for the purpose, were employed, the expense would not be more than 10*l.* The annual maintenance would consist of little more than the supply of a gas or an oil burner. The consideration of the expense, therefore, of maintaining such a system of signals at the necessary intervals on railways, is not for a moment to be set against the most remote risk of the least of all the numerous accidents, the records of which fill the public prints.

OBSERVATIONS ON THE MOTIONS OF SHINGLE BEACHES.

By Henry R. Palmer, Esq., F.R.S.*

From the Philosophical Transactions of the Royal Society;—read April 10, 1834.

The extraordinary prevalence of tempestuous weather during the last autumn having occasioned numerous disasters on our coast, the public attention was directed in an unusual degree to the imperfections of many of the harbours, and more particularly to those which are encumbered with accumulations of shingle. The access to harbours thus circumstanced is generally uncertain, and in tempestuous weather is frequently dangerous, or even impossible.

The action of the sea, which gives motion to the shingles and produces the evils complained of, has long been a subject of speculation; but I have not found that it has been systematically investigated. Indeed, the contrariety of opinions advanced upon the subject, sufficiently indicates an entire absence of that satisfactory mode of inquiry which is essential to the foundation of a safe and practical deduction.

Very little has been written upon the subject: and such facts as have been mentioned have only been referred to incidentally, or with a view to geological science. My present object is exclusively practical in its nature, and my observations have been limited to such facts as would assist in establishing certain and fixed rules for controlling the motions of the beach, so far as to enable us to preserve a clear channel through it in all seasons, and in every variety of weather; and to accumulate and preserve the shingles, where it is needful to do so.

The subject at first sight appears greatly complicated; and were it adheres; and therefore the following observations must be considered as restricted only to certain general principles, subject to a variety of modifications.

The principles which I propose to illustrate will (under similar circumstances) at all times exhibit the same phenomena, but for the sake of perspicuity I shall now only refer to the coasts of Kent and Sussex.

Section I.

That the pebbles which compose the shingle beaches on these coasts are kept in continual motion by the action of the sea, and that their ultimate progress is in an easterly direction, are facts long known and commonly observed. The following observations are chiefly directed to the particular manner in which the motions are produced.

From a general view of the effects that I have noticed, it appears that the actions of the sea upon the loose pebbles are of three kinds: the first heaps up, or accumulates the pebbles against the shore; the second disturbs, or breaks down the accumulations previously made; and the third removes, or carries forward the pebbles in a horizontal direction.

For convenience I propose to distinguish these by the following terms, viz. the first, the accumulative action; the second, the destructive action; the third, the progressive action.

All the consequences resulting from these various actions are exclusively referable to two causes. The one is to the current, or the motion of the general body of the water in the ebbing and flowing of the tides; the other to the waves, or that undulating motion given to the water by the action of the winds upon it; and it is of considerable importance to the present inquiry that the effects resulting from each specific cause be separately considered.

The motion of the shingles along the shore is commonly attributed to the currents, the action of the waves being considered only as a disturbing force. That such a notion is erroneous will, I apprehend, presently appear; although I have to regret that I have not had the opportunity of obtaining such satisfactory information relating to the velocities of the currents in the channel, as would have enabled me to include every form of argument upon the subject. The absence of such information has also prevented me from deciding satisfactorily as to the sources from whence the whole body of shingle is derived, which, although not necessary for the practical purposes I have in view, would have given more interest to the subject, and would have rendered the elucidation more complete. I must, therefore, for the present, be content to pursue the motions of the beach after it is found lying along or near the shore; observing only that the materials of which it is composed are those of the various strata in the vicinity of the coasts, together with the ordinary sea sand, and such small particles as may have been brought to the shore by the floods of the various rivers.

That the current is not the force which moves the pebbles along the coast, will appear from the following reasons:

1st. If it were so, the direction of the motion of the pebbles would be determined by that of the currents; but while the direction of the currents will vary with the changes of the tides, we find that the direction of the pebbles may remain unaltered; and also that the motion of the pebbles is continued where no current exists.

2nd. Although the velocities of the currents may not have been ascertained with precision, yet it is known that the velocities generally along this coast, which can possibly act on the shingles, are not sufficient to give motion to pebbles of every dimension, which are in fact carried forward.

3rd. The motion of a current will not produce that order in which the pebbles are found to lie, which order (as will be hereafter shown) may easily be distinguished as the effect of the motion of the waves only.

The direction of the waves is determined principally by the wind, the prevailing direction of which on the coasts referred to is from the westward. Every breaker is seen to drive before it the loose materials which it meets; these are thrown up the inclined plane on which they rest, and in a direction corresponding generally with that of the breaker. In all cases we observe that the finer particles descend the whole distance with the returning breaker, unless accidentally deposited in some interstices; but we perceive that the larger pebbles return only a part of the distance; and upon further inspection we find that the distance to which each pebble returns bears some relation to its dimensions. This process is an indication of the accumulative action.

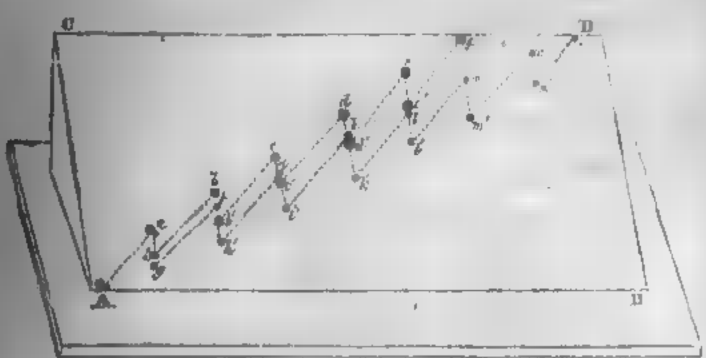
But under some circumstances, depending on the wind, it is found the level of the engineman's eyes; and that the point where the centre of the beam would intersect the horizon, A C, of his vision at E, should be about 700 feet from the lens. The impulse of the light would be most advantageously received at some point as near the lens

* The construction of harbours, piers, and breakwaters is likely to become of considerable importance to the engineering profession; we therefore propose to collect for publication in the Journal, such papers as have been written on the subject.

necessary to discuss minutely all the modifications arising from the variety of forms and local circumstances, it would perhaps be too much so for general description. I have, however, limited my investigation to those simple and unvarying laws to which nature always that pebbles of every dimension return with the breakers that forced them up the plane, and that these are accompanied also by others, which had been previously deposited, but which are in such cases disturbed by the waves; and by a continued repetition of the breakers acting in this manner, the whole of the shingle previously accumulated is immersed below the surface of the water. This process is an indication of the destructive action.

The particulars of the accumulative action, *combined with that of progression*, are explained as follows. (Fig. 1.)

Fig. 1.



Let A B C D be an inclined plane, representing that on which the loose pebbles move. Suppose the wind to blow in such a direction as to cause a wave to strike a pebble at A, in the direction of A *a*, and to the distance (*a*) up the plane, that point being the extent to which the force can reach. Now here the wave breaks partly into spray, and is dispersed in all directions; is partly absorbed, and descends in a shallow form, which rapidly diminishes in its depth, so that the pebble is soon left exposed, and therefore does not return the whole distance with the water, but is left at rest at (*a'*), being at a higher level than that from whence its motion commenced.

With the rise of the tide the striking force is also elevated; and by the repetition of the operation described through the different heights in succession, the further motion of the pebble will be represented by *a' b' b' b'*, &c., the distance in each step of its descent being something less than in that of its ascent, until it has reached the summit (*f*) determined by the height of the tide. Now if we suppose a pebble of less dimensions than the former to be struck from the same point, we shall find it raised as before; but because its surface is greater in proportion to its weight, and because from its less bulk it remains longer immersed in the declining wave, it will descend further, and follow the line (*a g*, &c.), and will not be left at rest till it has reached (*o*).

If, then, we suppose a pebble whose dimensions are less than either of the former, it will be evident that the point at which that will arrive on the highest level will be more distant still; hence it follows that the distance travelled horizontally by the pebbles during a tide will be in some proportion to their bulk, the specific gravities being the same.

(The pebbles do not in reality move in straight lines, but in a succession of curves; the straight lines are assumed here, and in other parts of this paper, to simplify the description.)

I trust it is only necessary to remark, that if the wind continue to blow in the same direction during the ebbing of the tide as through the flowing of it, the direction in which the waves will strike the shore will be nearly the same, and the progress of the pebbles will be urged by a similar action, and therefore their direction will also be the same.

In this action we observe a constant tendency to heap up and accumulate the shingles; and it is an interesting fact, that when the action has continued equally through a tide, the pebbles are left *in regular order, according to their dimensions*, the largest being uppermost, and the smallest at the bottom of the plane. I do not mean to state that all the largest are at the top, or that all the smallest are at the bottom, for it is evident that some of every size will be found at every level; but that if an equal measure (say half a peck) be taken from the different levels, the average of each specimen will exhibit in regular order the various dimensions.

The order in which the pebbles are thus found is, then, that by which the effect of the waves is distinguished from that of a current, the effect of the latter consisting only in its influence on the direction of the impinging and recoiling motions of the waves, by which the motion of the beach may in a small degree be accelerated or retarded.

SECTION 2.

In the illustration of that action of the sea which breaks down and removes an accumulation, I propose referring to my observations in the order in which they were made. My attention was first directed to this part of the subject in the neighbourhood of Sandgate in October last.

The accumulative action had been continued for a considerable time. The numerous groins erected near Folkstone to impede the progress of the beach, for the protection of the cliffs, had collected a bank of pebbles, which in some parts was five feet in height. The wind had so much abated as to be scarcely perceptible, but the sea had a motion denominated a *ground swell*.

The waves approached the shore nearly at right angles with it; but although in rapid succession, their forces were very moderate. These circumstances continued through five tides, by which time nearly the whole of the loose shingle had disappeared, including all that had been collected by the groins at Folkstone. The water being particularly clear, I was enabled to perceive distinctly the action upon the pebbles, and their motion downwards. I observed, that although every wave became broken and dispersed as usual, yet they followed in such rapid succession, that each wave rode over its predecessor while on its return, and thus produced a continual downward current, which carried with it the pebbles that were disturbed. That the pebbles were not removed far from the line of low water, would appear from the fact, that on the subsiding of the swell, it being succeeded by a light breeze of wind from the westward, the accumulation immediately commenced, and was restored to its former quantity by the action of four tides. I have subsequently had some favourable opportunities for making other observations on the effects produced by different rates of succession of the waves, and particularly at Dover, during the late gales, where the same actions were noticed. There I watched for an opportunity of witnessing that rate of succession which exhibited the destructive and accumulative actions in their smallest degrees; and I observed, that when ten breakers arrived in one minute, the destructive action was but just evinced; and that when only eight breakers arrived in the same period, the pebbles began to accumulate; which facts harmonized with my observations made at Sandgate and Folkstone, viz. *that the difference between the two actions was determined by the rapidity in succession of the waves upon the shores.*

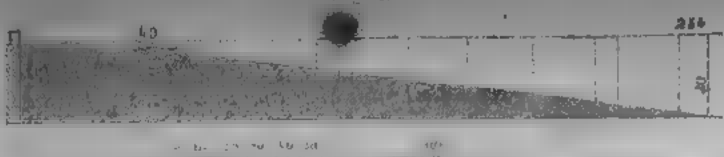
In the description of the accumulative action, I have assumed the forces to be directed obliquely with the line of coast, and have therefore necessarily included the progressive motion; but it remains to be explained in what manner the shingles are carried forward while the destructive action is going on.

It is known that the action and re-action of the waves give to the whole body of the water, within a certain distance from the shore, an undulating motion. The direction of this motion, when approaching the shore, will, to a certain degree, correspond with that of the waves upon the surface, and the direction of the recoil will also be affected in like manner; therefore the pebbles that have been carried down by the destructive action are moved forward through an angular course *beneath the water*, until, by the excess of the impinging forces over those of the recoil, they are again raised by the action of the water, and deposited where the destructive action has ceased, or where, from local circumstances, it cannot occur. The circumstances which are most unfavourable to the destructive action are those which least admit of the constant downward under-current,—an inlet, or narrow arm of the sea, for example. If we suppose a wave rolling through the mouth of an inlet, carrying with it a charge of shingles, it does not break as upon an inclined plane, but is dispersed in the general body of the water, which is comparatively quiescent; and there being no returning force, the shingle becomes deposited, and a bank is formed: and although the destructive process would act upon that bank if it could attain a certain height, yet the attainment of that height is prevented by the waves passing over it, and carrying with them, in succession, the shingles with which they are charged.

SECTION 3.

In fig. 2 is represented a section of the beach formed along the outside of Folkstone Harbour. This section was taken with great accuracy, after the ground swell before referred to had removed most of the loose pebbles from it; so that the section may be considered as representing the plane upon which the progressive motion of the pebbles is carried on. Its slope is in the proportion of 1 to 9, nearly, and (with the exception of that part near the summit where there remained

Fig. 2.



a bank of pebbles beyond the reach of the previous tides,) the surface of the plane corresponds very nearly with a straight line, which, considering that it is a natural formation, is a fact worthy of notice.

I think this plane may be considered as representing the average dimensions and inclinations of the surfaces over which the beach travels along this coast, and I have therefore generally assumed such an one for the present purposes. Upon such an inclination, the loose pebbles are in contact with each other; and although their depth upon the plane is constantly varying, yet, for the sake of conveying a general idea, we may assume the average to be about six inches, extending between high and low-water marks. When, however, the plane is less inclined, the same quantity of beach is spread over a larger surface, and its depth is diminished; and the pebbles are in some places so far separated as to exhibit the appearance of a diminished quantity. In fig. 3, this is illustrated geometrically.

Fig. 3.

Let A B represent a plane on which all the pebbles are in contact, C B a plane considerably more inclined. If, from the centre of each pebble on the plane A B, a horizontal line be drawn to the plane C B, the position of the pebbles on the latter will be respectively at the various points of intersection.

Section 4.

There are numerous points on the coast at which the line of beach is apparently intercepted and its continuity destroyed, and the rock washed bare. Having sufficient evidence that the motion of the beach was continuous, I thought it important to ascertain in what manner the pebbles escaped past those places, and was happy in finding, upon investigation, that a valuable deduction could be made.

In the description of the accumulative action, it was remarked that the waves having struck the pebbles upwards, became dispersed, and were incapable of returning them to the level from which they were forced. But I now observed, that the surface of the rock, being very irregular, constituted numerous channels; so that the waves, instead of returning in a dispersed and weakened form, moved back in columns, which were of sufficient power to return every pebble that had been thrown up; and as these channels offered no impediment to the angular progressive motion of the pebbles, it was more rapid than on the ordinary plane surface. Here, then, was pointed out by nature a principle on which the shingles might be hastened forward, and their accumulation about any particular place prevented; and by simply reversing that principle, a method of accumulating or retaining the shingles, where they are wanted, is also suggested, viz. by the reduction of the descending force of the breakers.

The effect of confining the retiring breakers to a column is also exemplified in another manner, when the waves are driven directly upon the beach by a moderate wind, or such as would produce the accumulative action. A succession of waves, acting over the same lines of the beach, soon forms a slight depression, which continues increasing until it becomes a definite channel. The whole line of beach being thus acted upon, it assumes the form of a series of banks parallel with each other. The waves do not then recoil in a dispersed form, but, having broken, are again collected and returned through the channels, and remove all loose matter from them. While in this state, the beach has no progressive motion, but continues (to use a military term) "marking time," until, from the change of wind, an oblique direction is given to the motion of the waves.

Section 5.

The progressive motion of the beach may be easily traced along the coast as far as the bay called Sandwich Flats. The general character of the motion during its progress is that which is most favourable, under every circumstance, to the chances of becoming securely deposited. Every part of the coast is attempted by every variety of motion in its turn, until a place of final security is discovered.

The locality of Romney Marsh appears to have afforded the sought-for shelter, and now exhibits an extraordinary example of the accumulation, which, having been combined with sand, silt, and vegetable soil derived from other sources, has long been considered an acquisition to our surface of considerable value.

Although this tract has continued increasing to the present day, yet a great quantity of the beach travels past it, and we do not find any other accumulation of much extent between that and Sandwich Flats, beyond which there is no further trace of the shingle which we have so far followed, the pebbles to the northward of these flats being evidently those derived from the cliffs near about them.

On the approach of the shingle to the Sandwich Flats, it becomes gradually dispersed, owing to the increasing inclination of the plane, until it seems to disappear. A considerable extent of these flats has attained a height very little inferior to that of the high-water mark of spring tides; and it is so nearly horizontal, that the water does not partake of that undulating motion upon it which has before been adverted to.

On the Sandwich Flats there is a continual deposit of soil and silt, brought there from the interior of the country by the river Stour, and which, after its exposure to salt water, is particularly suitable for permanently uniting all the coarser or larger fragments with which it may become intermixed. So much of the materials which have composed the beach as may be conveyed to the higher parts of these flats are not likely to be again disturbed, because many days may intervene before another tide may reach them; and they thus become united to the surface on which they rest, and gradually contribute to its height.

The greatest motion of the pebbles being where they are exposed to the action of the greatest number of waves, we must look to the lower levels of these flats to trace the further course of the greater portion of the shingle. But even the slope of the surface of the lower levels is so very gradual, that the undulating motion of the water is proportionally diminished; *the action of the water then becomes greatest in the direction of the land.* While, then, we bear in mind the nature of the soil over which it acts, we find an almost insurmountable impediment to the further progress of the shingle, and are enabled to account for the rapid extension of the Sandwich Flats towards the sea, which, in fact, is only the continuation of that process which has been for ages in operation, and which has formed a large portion of those extensive marshes between the Isle of Thanet and the main land of Kent.

Section 6.

Having described those chief principles which regulate the motion of the shingles on this coast, and having traced their progress to a final destiny, I shall now proceed with some further general remarks referring to the application of the foregoing observations.

So much effect has been attributed to the motion of the tidal currents, that vast sums have been expended in attempts to divert the motion of the shingles to a distance from the general line of the shore, from whence, by the increased depth and velocity of the current, it has been expected they would be carried past a particular spot, through which a permanently open channel has been required. Such attempts have been made at various periods during upwards of two centuries at Dover, and more recently at Folkstone in the same neighbourhood. It is hardly necessary to observe, that such attempts have not been successful, and from the principles which I have laid down, their failure may be easily accounted for.

If a wall or pier be extended from the shore into the sea, it is evident that such erection will in the first instance impede and prevent the progressive motion. It is also evident, that the progressive is not necessarily combined with the accumulative action, but, on the contrary, where the former is impeded the latter is assisted. The accumulative action, therefore, continues until the angle formed by the pier and the line of the shore is occupied, and the pier being no longer an impediment to the progressive motion, that motion is again restored, and the general mass proceeds as if no impediment had existed.

The most perspicuous evidence of these results is exemplified at the harbour of Folkstone. Previously to the commencement of this exclusively artificial work, the beach travelled along the line of cliff in the ordinary way.

By extending the walls a sufficient distance into the sea, it was expected that a commodious harbour would be formed, and the shingles diverted so far into deep water, that they could not again appear above the surface until they were removed beyond the harbour's mouth.

The accumulation, however, immediately commenced, and continued as the work advanced until it became apparent that no other effect was produced upon it than a comparatively slight change of direction.

The entrance of the harbour being much encumbered with shingle, an additional pier or jetty was erected, and extended about two hundred feet further into the sea without having approached the effect intended. It is true that some advantage was derived from the extended pier, by increasing the distance between the most violent action of the breakers and the still water of the harbour. The shingles, therefore, pass the mouth in a more dispersed form than they originally did, and hence they do not so readily form a barrier, neither does its perpendicular height become so great.

Much valuable information on this part of the subject is recorded in LYON'S History of Dover, which, as it may at any time be consulted, is not repeated here. I shall only remark, that from the succession of experiments made at that place, the general result has been in a considerable acquisition of new land, which, although valuable in itself, is not the object intended to be obtained.

If, then, it be admitted that projecting piers will not prevent the encumbrance about the mouth of a harbour, situated as those referred to in the tract of the restless beach, it remains to be seen how far such works may be otherwise injurious.

While the accumulative action is going on, every abrupt projection from the coast is an impediment to the progressive motion of the beach until its angle is filled up. Such abrupt projections offer no protection against the destructive action; when, therefore, by the increase of wind, the action of the sea becomes violent, an accumulation previously caused by a projecting pier is rapidly removed, and again is rapidly deposited where it is not resisted. And there is perhaps no combination of circumstances less capable of resisting, or more favourable to the deposition of, the shingle, than is found in artificial harbours, shielded by an *abrupt* weather pier in a line of beach.

With a long continuance of violent winds from the same quarter, every accumulation of loose shingle is broken down, and is hurried forward, while it unremittingly appears to seek protection. During the recent gales every inlet within the tract of the beach was seriously encumbered with it; commenced with the heap accumulated by the very pier that was intended to prevent such an effect (where such existed), and increased by the successive arrivals of those more remote, together with that quantity commonly passing along the sloping plane, but now brought down by the destructive action and forced along with accelerated motion. * *

Many very interesting facts might be mentioned concerning the effects produced by the continued gales at various places on the coast, but I find that the description of them in sufficient detail to make them useful would extend this paper much beyond the limits assigned: I, however, trust that the reference to two of the most remarkable cases will be found sufficient to illustrate the principles attempted to be explained.

SECTION 7.

The only natural power by which the channels through the beach are retained, is the returning force of the water, which on this coast is generally scanty. And it is obvious, that however judiciously that force may be employed, it is but *remedial in principle*, and necessarily implies a previous evil. So long, therefore, as the cause continues to act, the remedy is prevented, and the harbour becomes inaccessible when protection is most required.

If on inspection of the great bank recently thrown up at Dover, we imagine it to be dispersed over several miles of the sloping plane, and assume the whole to be in continued and equable motion, it will immediately be inferred, that the quantity that would be passing a given spot at one time would be comparatively insignificant; and hence, since we have no reason to suppose that there will be a limit to the quantity, and since it has been shown that its motion cannot be prevented, it follows that the great objects in view must be attained, first, by securing permanently such accumulations as are necessary for the protection of land from the action of the sea, or useful by their addition to its surface; and secondly, by facilitating and inciting the progressive motion of that superfluous quantity from whence the evils complained of are derived: and therefore the uninterrupted and permanent welfare of the numerous harbours which communicate with the sea, through the extensive tract of the shingle beach, is dependent more on a *system of management along the coast*, than upon particular devices adapted exclusively to each separate case.

Engraving upon Metals.—M. Melloni has announced to the French Academy that M. Circlli, of Naples, has been able to obtain plates upon metals by galvanoplastic methods. His discovery is to form immediately the plate completely engraved after a simple design. M. Melloni has submitted some of the plates to the inspection of the Academy. The process is not detailed, as Circlli is preparing to secure a patent for it.

PREVENTION OF EXPLOSION IN STEAM ENGINE BOILERS.

The Gold Isis Medal was presented by the Society of Arts to Mr. Robert M'Ewen, Glasgow, for his Double Mercurial Safety-Valve for Steam Engine Boilers.

THERE are two evils against which it is especially necessary to provide in the construction of an apparatus for preventing explosion in boilers, viz. the possibility of the steam passage being intentionally closed, for the purpose of obtaining extraordinary pressure; and the failure of the self-action of the apparatus through the accidental derangement of its parts.

Mr. M'Ewen's apparatus consists of a pair of open tubes, the ends of which are immersed in mercury contained in cups connected with the boiler by a pipe. At the junction of this pipe with its branches for the two cups, is a three-way cock, the ports of which are so proportioned to the openings of the branch pipes, that the steam can neither be opened on, nor cut off from, both cups at the same time. The mercury tubes are proportioned in length to the greatest pressure which the boiler will bear with safety; the mercury will therefore be blown out of the acting tube into the dome at the top, whenever the pressure exceeds this limit, and will fall down through the other tube into the empty cup, while the steam blows out through a pipe at the top of the dome.* When the pressure is sufficiently reduced, the cock may be turned, and the cup which was last filled becomes the acting side of the apparatus.

On the 7th of April, a committee of the Society inspected the action of Mr. M'Ewen's mercurial valve, the apparatus having been attached to the boiler at the works of Messrs. Fairbairn and Murray of Mill Wall. The steam was opened on the mercury at a pressure of five pounds to the square inch, and as soon as it attained the pressure corresponding to the length of the tubes, viz. seven pounds, the mercury was blown, without any loss, into the dome and fell into the empty cup, while the steam blew out through the pipe at the top of the dome, and was condensed in a vessel placed to receive it for the purpose of experiment. On examination of the water in this vessel, not a particle of mercury was found in it. This result sufficiently proved the efficiency of the pipe, which is produced to some distance downwards within the dome, as represented in the section fig. 1, for the purpose of preventing the mercury from splashing out with the rush of steam.

As the action of this apparatus depends simply on a *physical* principle, viz. the opposition of the elastic force of steam to the static pressure of mercury, without the intervention of a *mechanical* obstruction of any kind, it cannot fail of acting, so soon as the pressure of steam exceeds the limit corresponding to the length of the tubes. The novelty of the invention is in the employment of a mercurial tube as a safe vent for the steam, these tubes having hitherto been used only as indicators of steam pressure, being long enough to allow the steam to attain a dangerous pressure without relieving it or giving any other notice of the fact than what may be observed by the eye.

REFERENCE TO THE FIGURES.

Figure 1 represents the whole apparatus in section. A the pipe connected with the steam boiler, B the hollow plug of a cock with a side opening at C, through which the steam passes into the area D, and pressing on the mercury causes it to rise in the tube E till its weight counterbalances the force of the steam; the tube E opens into the chamber and dome F, to which there is free access for the atmosphere through the neck G; if, therefore, the steam should at any time exceed the due pressure which is limited by the length of the tube E, it will drive all the mercury before it up this tube into the chamber F, and will escape through the neck G; in the meantime the mercury will enter the opposite tube H through the small hole I, and flow down into the other vessel J, where it will be ready again to act as a safety-valve as soon as the attendant has turned round the plug B by its handle K, thus cutting off the communication of the steam with the vessel D, and opening it into the vessel J. The construction of both sides of the apparatus being exactly alike, the tube E having an aperture at L to receive the mercury from the chamber F, this operation may be repeated as often as the escape of the steam gives notice of its being necessary. The bottom of the chamber F, though straight from L to I, is curved like a trough in the cross diameter, as shown by the curve under F, to conduct all the mercury through the hole I or L, whichever may be opposite the acting tube.

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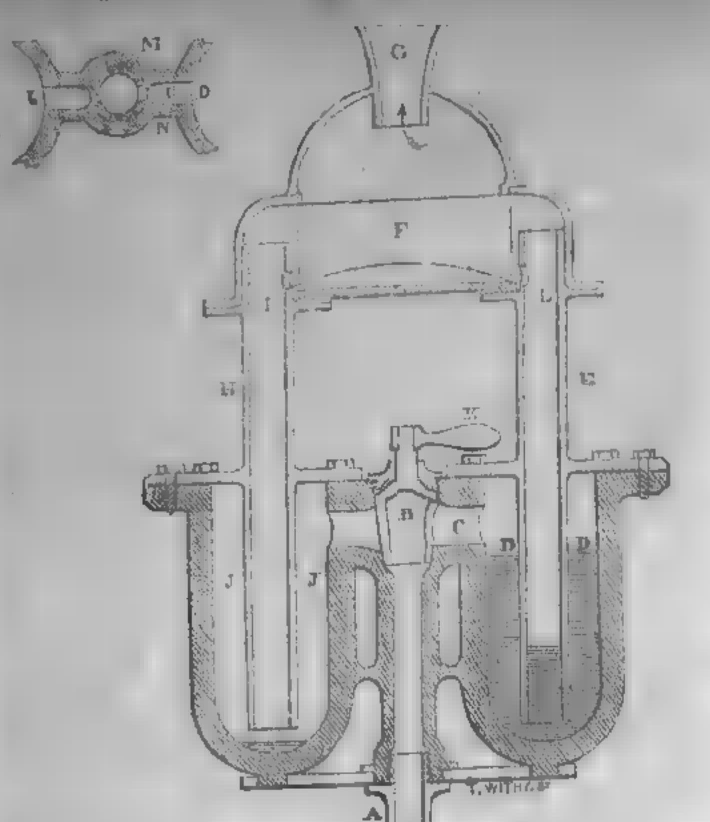
* Mr. M'Ewen intends that an alarm-whistle be placed in this opening, and also that the apparatus serve as a gauge for indicating the variation of pressure, by means of graduated float-rods in the mercury tubes.

Fig. 2. Fig. 1.



For the sake of perspicuity, only one side opening from the plug B has been adverted to. But the plug is always made with three openings, as shown in fig. 2, at C, M, and N; by which it will be seen that it is impossible to shut more than one of the chambers, D or J, at the same time. The engineer, therefore, has not the power of completely shutting off the steam by means of the cock, nor could a successful attempt be made to effect this by plugging the pipe in the dome, the material of the latter not being of sufficient strength to bear as high a pressure as the boiler.—*Trans. Soc. Arts.*

S. L. AND THE PROFESSOR OF ARCHITECTURE.

SIR.—The freedom of some of the comments in my last Fasciculus must, no doubt, have startled your correspondent S. L., and also convinced him that I fully act, *i.e.* write, up to my motto, which is very much more than can be affirmed of every one who bears a motto. It is evident he considers me as having made much *too* "free with the Professor of architecture at the Royal Academy;" just as if the Professor was a schoolmaster—some village Solomon whose sceptre is his birch, and whose subjects are bound to listen with awe to whatever he utters. What indecorum there can be in animadverting upon opinions enounced by the Professor in his public capacity, I cannot possibly conceive. Similar freedoms are taken every day with persons and personages who are quite as important—at least people fancy them so—as Professors of architecture: a truth well known to Lord Melbourne, and Lord John Russell, and to a great many others before them.

It is, I believe, generally understood that the freedom of remark which would be indelicate and reprehensible towards private individuals, is perfectly allowable towards public men, and those who hold public situations which give an influential authority to their opinions. On the last account it is, that opinions promulgated *ex cathedrâ* should be narrowly watched and scrutinized; and if they will not bear a little rough handling when examined, they are fit only to be bandboxed in lavender, and brought out, not in the lecture room, but in the drawing room.

For my part, I hold the squeamishness and affected delicacy which usually pervades architectural criticism to be not only exceedingly silly, but exceedingly mischievous into the bargain; for they tend in fact often to stifle criticism itself just at the very time when it might be applied with success; and grant impunity to some of the greatest delinquents, and to the abominations perpetrated by them, under the paltry pretence of its being a delicate and invidious task to speak of men and matters belonging immediately to our own day. This excessive caution—not to call it time-serving obsequiousness and cowardice—is almost peculiar to those who write on architecture; most certainly we find very little of it in literary criticism; where the merits of living writers, let them stand ever so high, are often discussed with a freedom that is almost startling, or at the best very unceremonious.

However, all that I have just been saying will be thought little better than evasive remarks, under cover of which I am fain to sneak off and screen myself from the allegation made by S. L., and therefore now say in reply to it, that erroneous or not, the impression left upon myself, and a good many other persons also, I believe, was that the Professor's views were so far unfavourable to Gothic architecture as to discourage it most decidedly at the present day. To be sure he expressed a decent "for-good-manners'-sake" admiration of it, just of that sort and no more which may be professed for any other by-gone and worn-out style of the art—for Egyptian or Byzantine curiosities in it. An enthusiastic devotee in his rapturous reverence for the sublime Sir Christopher Wren,—who, by the bye, produced Temple Bar and sundry other pieces of veritable architectural bathos—the Professor is evidently ill-disposed towards the practical application or adoption of Gothic at the present day. So likewise is S. L.; and therefore both of them may probably object to the style selected for the new Houses of Parliament, and may also greatly prefer Buckingham Palace to Windsor Castle—perhaps regret that Mela Britannica's advice was not taken in regard to the latter structure; had which been done every vestige of it would have disappeared, and a low moderate-sized Grecian edifice, a mere parallelogram in plan, would have been substituted for it, as worthier to grace the acropolis of Windsor!

It would seem that mullioned windows do not accord very well with plate glass, but "are more suitable for casements with small panes of glass than for the large squares now in use." Now it may fairly be admitted that small panes do not at all disfigure Gothic windows—do not produce the same mean and palty effect they would in others; but it does not therefore exactly follow that they are indispensable to propriety of character, because, if well designed in other respects, the windows lose nothing by each compartment being filled with single plates of glass. On the contrary, the use of glass of such dimensions removes in a great measure the objection apt to be entertained against mullions of suitable proportions, as obstructing light; because, owing to the greater size and transparency of the glass, as much light is transmitted through the same space interrupted only by bold mullions, as where the mullions are very scanty, and the general surface consists of a meshwork of lead in which the glass is fixed. The chief difference between a window with small panes and one without divisions of the glass, is that in the latter case, if the entire aperture loses somewhat of the character of a glazed Gothic window, it will still resemble what is equally beautiful in the same style, namely an open screen with unglazed compartments.

But if Gothic is inapplicable because of so slight a difference as that arising from the windows being glazed with large pieces of glass instead of diminutive panes, how is it possible for us to reconcile ourselves to the infinitely greater departure from the genius of Grecian architecture, by introducing, as we most freely do, into that style, features not only unknown to, but absolutely at variance with it, not only windows, chimneys, balustrades, attics, &c.; but successive tiers of windows and windows throughout, windows within porticos, &c.? Again, small panes set in lead are to the full quite as unsuitable for windows in Grecian or Roman architecture, as they are suitable in the Gothic style, which being the case, have we not a right, according to S. L.'s notions of consistency and propriety, to be very much shocked at the semi-Gothic or Gothicly glazed windows of St. Paul's cathedral?

S. L. talks of the "difficulty of persuading persons to adopt Gothic, who are not possessed of antiquarian taste." How happens it, then, that we have so many soi-disant Gothic churches and Gothic mansions which are in utter defiance of antiquarian taste or any other? why are we doomed to behold so much hole-in-the-wall Gothic—so many castellated fancies *à la Lugar*? For no other reason than because there is a bigotted and fashionable prejudice for the mere name of the style among persons who have not the slightest notion whatever of the style itself. The difficulty is not to persuade people to adopt, but to dissuade them from thinking of at all adopting a style which they will not allow to be properly treated.

Again, S. L. assures us that when modern architects design in the Gothic style, their object is imitation, but that when they employ Grecian or Roman, their aim is INVENTION!! Now no man would have ventured upon so very bold an assertion unless he had previously fortified himself and screwed up his courage to that pitch by an extra

dose of claret or champagne, it being most palpable and notorious that all our Anglo-Grecian architecture betrays UTTER WANT OF INVENTION. Invention forsooth! then invention must consist in making fac-similes of Grecian columns, and poking plenty of sash windows between them: or in showing ugly chimneys, garret windows, and skylights over Grecian entablatures more faithfully than tastefully copied for the nonce, or if invention be occasionally shown, it is done after the fashion of Nash and Smirke, the former of whom has given us a Grecian Doric order in a palace, without triglyphs or even any division of frieze and architrave in its entablature, while the other has introduced doors not at all better than those of a stable or coach-house into the *classical* portico of Covent Garden theatre, *said* to be copied from that of the Parthenon, and whose columns some unlucky gin-and-water critic has described as Ionic!

If S. L. can now explain away some of his own very awkward and untoward remarks, all well and good. To do so would at least display some ingenuity. All that I am afraid of is, that he will not make the attempt, but that he will henceforth be cautious of getting into a scrape by taking the part of the Professor of architecture, and leave the latter either to defend himself, or to submit to the incorrigible sauciness of

CANDIDUS.

THE ROYAL EXCHANGE.

SIR—If I am rightly informed the design for the New Royal Exchange has undergone considerable changes and modifications, especially as regards the interior court, in respect to which, if no other part, there certainly was great room for improvement, therefore as far as architectural character is concerned, I am willing to believe that improvement has been made. But why is the Exchange itself to be an open court at all? others besides myself have asked the same question—at least have animadverted upon the absurdity of making the area in which the merchants are to assemble an uncovered one, with no other shelter from the weather than what will be afforded by the ambulatories around it. The inconveniences attending such a plan are obvious enough; what countervailing advantages are expected it is difficult to guess, but it may be presumed that they are sufficiently important ones; consequently it would be but proper that they should be stated, if only in order to exonerate those who have control over the building from the charge of being guided as to so very important a point solely by obstinate caprice, and adopting what will be a serious inconvenience for no better reason at all than because it existed in the former structure—when, by the by, it was at one time contemplated to obviate it by covering in the open area. It would seem that now it is known that the building is to be erected by Mr. Tite, all interest in regard to it has entirely subsided. This ought not to be; nor ought such matters to go to sleep, and be treated as if utterly indifferent, because no one has now any thing farther to expect from any change that may take place. If reasons or any thing like reasons can be alleged for leaving the body of the Exchange entirely exposed to the weather, let them be stated and then we shall know on what grounds it has been determined to adhere in the new building, to what many considered an inconvenience in the former one.

There is, I find, an article on the Royal Exchange in the Penny Cyclopædia, in the course of which objection is made to the merchant's area being left uncovered in the new structure. What is there said, however, is not likely to attract attention—at all events not immediately, or so much as a few lines in your Journal.

I remain, &c.,

CIVIS.

London, April 14, 1841.

MR. MUSHET'S PAPERS ON IRON AND STEEL.

SIR—I lately had for the first time an opportunity of looking into Dr. Ure's very elaborate dictionary, and on referring to the article on Iron I was a good deal surprised to find that a table of the proportions of charcoal used in the fusion of bar or malleable iron to produce the various qualities of steel and cast iron, and published by me in the Philosophical Magazine nearly 40 years ago, had been subjected to severe and unmerited censure on the part of Dr. Ure for its want of accuracy.*

As this table (along with many papers principally on the subject of iron) has lately been republished at a very considerable expense, I consider it behoves me to protect the property so created, and to take care that where the work is free from error, it shall not suffer any deterioration by my silence in respect of the criticisms of others, in whatever spirit they may be expressed.

The criticism to which I allude (page 716 of the second edition of Dr. Ure's Dictionary), is evidently borrowed from Karsten, but as the matter does not stand in the Dictionary in inverted commas, I am entitled to assume that it contains Dr. Ure's opinion on the subject, and shall deal with it accordingly. It is as follows.

"According to Karsten, Mushet's table of the quantities of carbon contained in different steels and cast irons is altogether erroneous. It gives no explanation why, with equal portions of charcoal, cast iron at one time constitutes a gray soft granular metal, and at another a white hard brittle metal in lamellar facets. The incorrectness of Mushet's statement becomes most manifest when we see the white lamellar cast iron melted in a crucible lined with charcoal take no increase of weight, while the gray cast iron becomes considerably heavier."

In this extract two facts are alleged, namely, first, that the product obtained at different times by the fusion of the same quantities of the same iron with similar proportions of charcoal is irregular; and secondly, that gray cast iron acquires weight by its fusion with charcoal, while white iron does not. I deny both these allegations,—but supposing they were true, what has my table of proportions to do with them?

It is assumed by Dr. Ure that the table gives the atomic proportions of carbon *united with*, and *existing in*, the various qualities of steel and cast iron, whereas it only professes to give the proportions of charcoal required to be *presented to* bar iron in the crucible to afford the various qualities of the metal before alluded to, and this it does with a degree of accuracy which I challenge Dr. Ure and Karsten to disprove.

The experiments show in the clearest manner that charcoal is absorbed by iron; that gray iron absorbs a greater quantity than white, and that steel requires for its production a less proportion than white.

To guard against the inference which has been so inconsiderately drawn by Dr. Ure, the following passage was inserted in my work.*

"Although this is the quantity of charcoal necessary to form these various qualities of metal by this mode of syntheses, yet we are by no means authorised to conclude that this is the proportion of real carbonaceous matter taken up by the iron, seeing that in experiments Nos. 1 to 6 inclusive, the weight gained by the iron was upon the average equal only to 1-21$\frac{4}{10}$ part, whereas the charcoal which disappeared in the different fusions amounted to 61¼ per cent. of the original quantity introduced along with the iron."

Having in this paragraph taken the precaution to guard against misrepresentation, I am at a loss to account for the conclusions at which Dr. Ure has arrived.

It is quite evident that both he and Dr. Karsten are puzzled with some results for which they have not been able to account. They cannot, it would seem, explain why "cast iron (query, white, gray or motled) with the same proportion of charcoal sometimes makes white iron, and sometimes gray." Having had some experience in the treatment of iron, it is barely possible that I may be able satisfactorily to solve the difficulty, the weight of which they have flung upon my table of proportions.

I must in the first instance be allowed to deny the alleged fact, namely, that the same iron and charcoal are so capricious as at one time by their fusion to produce white cast iron, and at another time gray. The same substances which have once made gray iron will, if the operation be similarly conducted, do so on every occasion, and the same remark holds good in respect to the other varieties of the metal.

In order to understand this curious and not unimportant subject, it must be laid down as a maxim that the affinity between iron and carbon depends upon the degree of temperature which the iron will withstand before it enters into fusion: the higher the temperature short of fusion, the more rapid and extensive will be the combination: and the converse is equally true.

Hence the unerring certainty with which malleable iron and steel unite with carbon in the crucible, and become with an increase of weight rich carburets of iron. The same remark is applicable in degree to refined metal, which when of the purest and whitest fracture, will with its appropriate dose of charcoal also pass into the state of the most perfect gray iron. But the case is most materially altered when the experiment is performed with common white pig-iron or with gray: the greater fusibility of both these states of the metal does not leave time for the action of affinity to take place between the iron and charcoal, so that even with a higher proportion of charcoal the results come from the crucible to all appearance unchanged as to quality.

* See Mushet's papers on iron and steel, published last year by Mr. Weale.

* Page 526, towards the bottom.

This difference in the fusibility of the various states of iron affords a clue to the mystery which seems to have puzzled Drs. Ure and Karsten, who may perhaps have still to learn that charcoal never combines with iron after it has become fluid, and that the union is always effected by a process of cementation.

Suppose then that an experimentalist were in the first instance to fuse refined metal (which is the whitest of white iron), with a certain portion of charcoal, and to obtain a soft gray granular metal, this result would be uniformly obtained so long as the same substances were used, but were he to substitute for the refined metal, white cast iron, (which, to an unpractised eye, is not easily distinguishable from the other), and fuse it with the same, or with a greater quantity of charcoal, the result would not in this case be gray, but white cast iron, of the same appearance as when introduced into the crucible.

But it by no means follows that white pig, or cast iron, cannot be converted into gray iron in the crucible, for however great its fusibility, yet if a portion of those earths whose affinities for carbon are developed at page 558 of my work, be introduced into the crucible and fused along with white cast iron, and even a minimum doze of carbon, the result will be gray iron of the best quality. In short the same iron which when fused with half its weight of charcoal alone, comes out of the crucible white, will by the introduction of the earths be converted into rich gray iron with an increase of weight, and this result will be obtained with only $\frac{1}{25}$ or $\frac{1}{16}$ of its weight of charcoal.

Your's, &c.,
D. Mushet.

(To be continued.)

THE LARGE WATER WHEEL AT COLEBROOK DALE.

Sir—Thinking a short description of a water-wheel of no ordinary dimensions may be worth your notice, I send a slight sketch and a few of the principal dimensions of one erected in Colebrook Dale, Shropshire; it works an oil and colour mill, but as the speed and the supply of water vary considerably, no correct estimate of the power can be obtained, but it probably does not exceed 3 or 4 horses' power. The speed is generally about one revolution in three minutes, or 1·39 feet per second; part of the water comes on to the wheel at the top and part about 25 feet lower down.

Fig. 1.

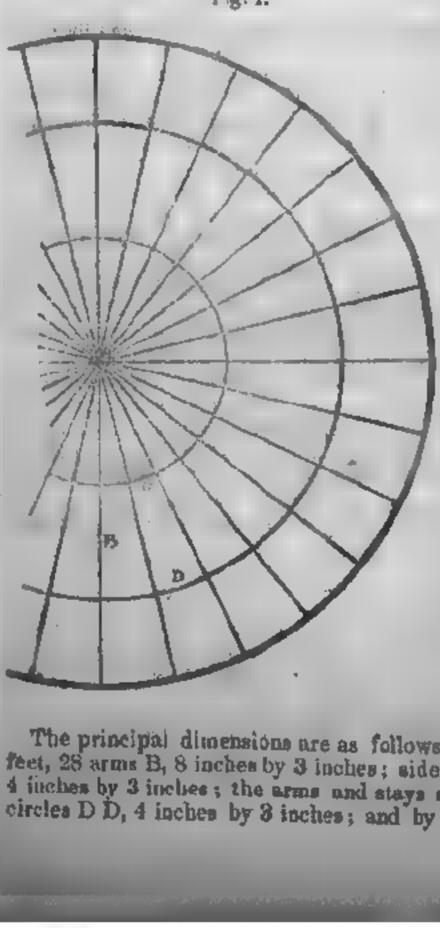
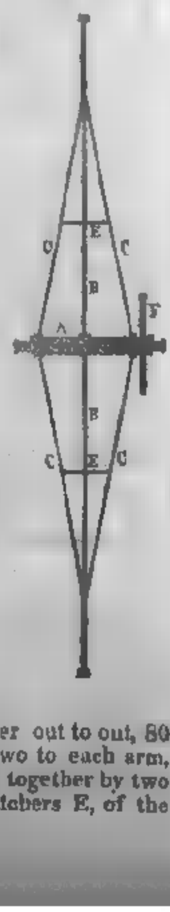


Fig 2.



The principal dimensions are as follows:—diameter out to out, 80 feet, 28 arms B, 8 inches by 3 inches; side stays C, two to each arm, 4 inches by 3 inches; the arms and stays are braced together by two circles D D, 4 inches by 3 inches; and by cross stretchers E, of the

Fig. 3.

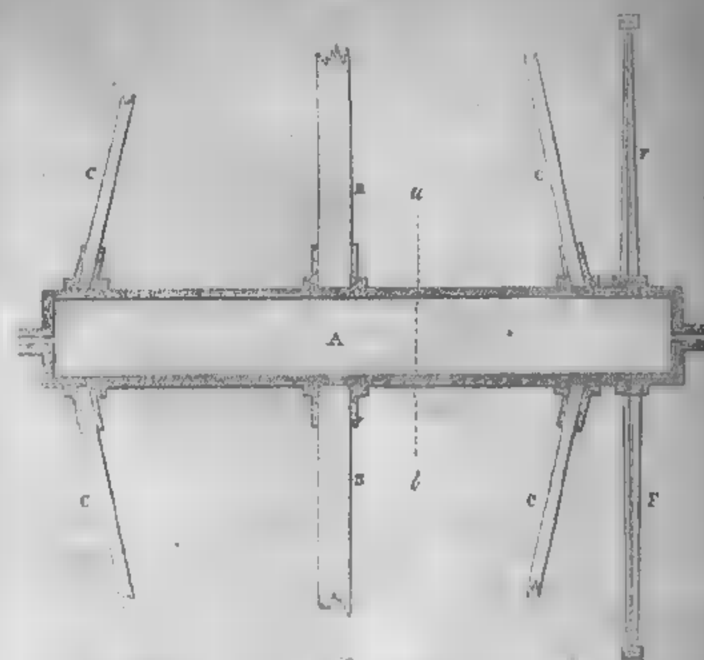


Fig. 4.

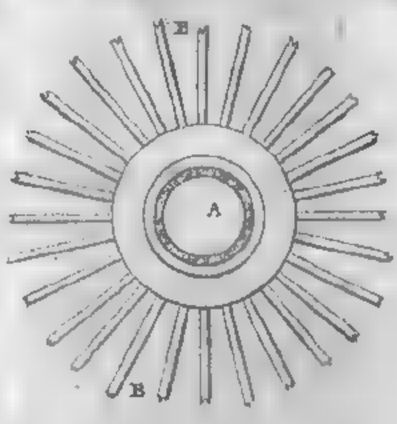


Fig. 5.

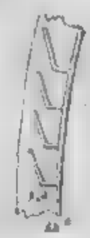


Fig. 6.

Scale of enlarged parts figs. 3, 4, 5, 6—quarter inch equal to a foot.

same dimensions. The buckets, of which there are 280, are 9 in. wide at the top, 5 in. at the bottom, 16 in. in breadth, and 10½ in. deep. The shaft A is of cast iron hollow, 14 ft. 8 in. long between the bearings, 26 in. diameter, with mortice holes cast in to receive the arms and side stays. The arms are of pitch pine, all the other parts are oak. The spur wheel F is 15 feet diameter. The breadth of the lines in the drawing are as near as may be the dimensions of the different parts.

Fig. 1 is an elevation of the wheel; fig. 2 a section; fig. 3 an enlarged section of the shaft A taken longitudinally, showing the manner in which the arms B B, and stays C, C, C, C, are fixed, and the spur wheel E, E; fig. 4 a transverse section of the shaft from *a* to *b*, showing the arms; fig. 5 is a section; and fig. 6, front view of the buckets.

I remain, &c.

H. C.

Railway Works in France.—The Havre Journal, in noticing the arrivals of wagons and workmen for the Paris and Rouen Railroad in that port, says that the wagons have been hired from the London and Southampton Company at a much lower price than they could possibly have been in France, and that the workmen who have been sent over, are all chosen from the most sober and laborious of their class that could be found in England. This journal takes the opportunity of pointing out the activity and energy shown by the English engineers, and the Paris and Rouen Company, and holds up their example to the notice of all engaged in France on similar works.

CAPTAIN CARPENTER'S PATENT QUARTER PROPELLERS.

In the Journal for February last, page 56, we gave an abstract of the above patent, we are now enabled through the kindness of the Editor of the *Mechanics' Magazine*, to give the annexed engravings, which better explain the action of the Propellers, together with an account of some experiments communicated by Captain Carpenter.

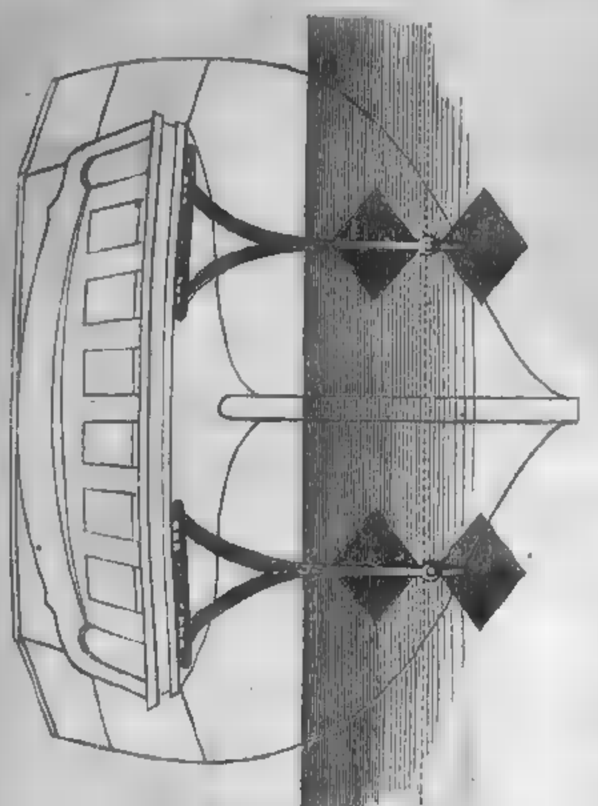


Fig. 2.—Stern view.

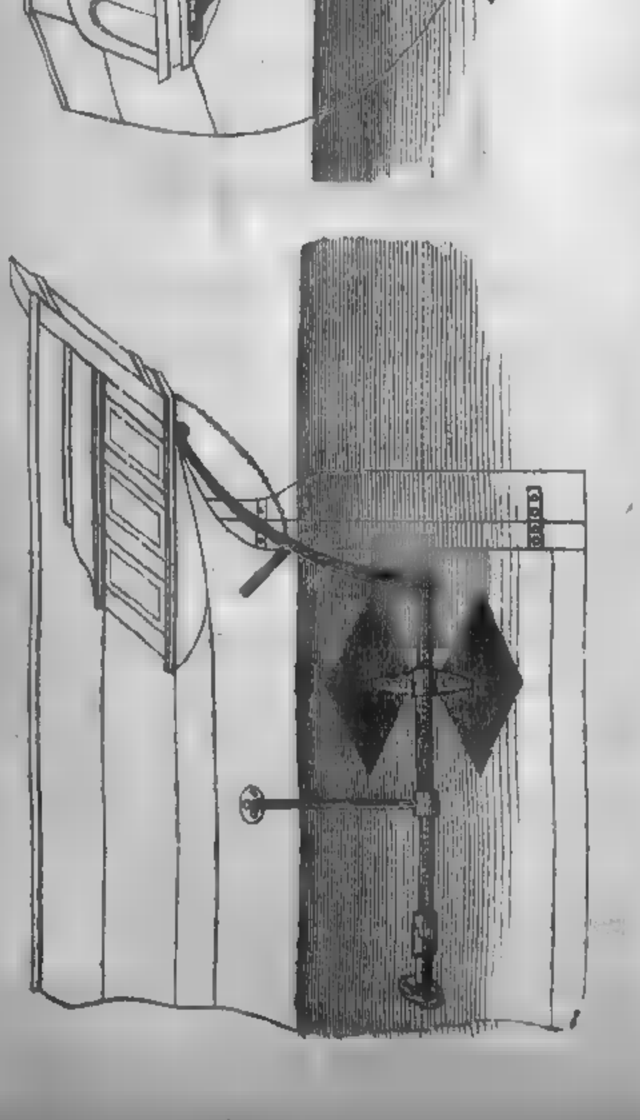


Fig. 1.—Side view of the Propellers.

"The first experiments (on any thing like a large scale) were on board the *Aerolite*, a vessel 69 feet long, and 9 feet beam. They were intended only to ascertain how far the apparatus was adapted to sailing vessels, for the purpose of moving them about in calms, or as an auxiliary to the wind and sails. The powerful effect produced by the rotation of these 'quarter propellers,' even by manual power, was enough to establish the fact, that any vessel, however large, may be moved in an opposite direction to that line in which the force is applied, quicker or slower, according to the extent of the motive power.

"The next experiments were made with a model of a steam-boat, which is now exhibited at the Polytechnic Institution. This model is supplied with the means of applying a great variation of power to the propellers, and it admits also of great variation in the shape of them, by which means I have had an opportunity of judging upon the merits of screws, sections of screws, and planes; and of testing the angle of incidence, the shape of the vane or blade, and the relative proportions they should bear one to the other, according to the power applied. Although a screw is decidedly a powerful instrument in the water, I must nevertheless give the preference to the plane and to the figure shown in the accompanying drawing, because it produces the greatest speed with the least sacrifice of power, more especially when the vanes are set at the angle of 30° or 35° to the axis of the shaft. And here I would remark, and hope without presumption, that if any merit may be attached to this part of my invention, it consists in the discovery by careful experiment, that a plane having the proportions of my propeller, as represented in the drawing, will, when set at the above angles, and revolving in the water, impel a vessel by means of a locomotive power, and the resistance offered by the fluid, with a greater effect than any other instrument yet adopted in navigation, which may be proved by mathematical demonstration.

"The next experiment was made in a boat 21 feet long, and 4 feet 8 inches wide. It is necessary here to remark, that only one propeller was used, and that was placed in the stern. The object of which was, to test the shape of the triangular propeller against the screw, and other propellers with the same power, the same position, and the same machinery; but it is so difficult to make everything bear in an equal proportion, that I doubt whether the experiments can be considered conclusive. I do not apprehend there would be so great a difference as 3 to 6 between Mr. Rennie's propeller, Mr. Smith's screw, and my triangular propeller, as stated in your journal, if the experiments could be made equal in every respect, but that is impossible. Mr. Rennie's experiments, I believe, were made in a heavier boat than the one I used; and although there may not be much difference in the area of the midship section, still as there might have been a difference in the strength of the men and other circumstances, I do not think a comparison could be established; I therefore only presume to give you for data this fact, that with the very same propeller as I now send you, the boat was propelled with two men turning the winch, 88 measured yards in 33 seconds, and sometimes in timing it, it appeared to be 30 seconds—the propeller making 119·5 revolutions in that time."

"A screw propeller placed in the dead-wood of the *Archimedes* Yacht, has, it would appear from the public papers, fully established equality of speed with the common paddle-wheel. This propeller differs in *form* and *position* from the '*quarter*' propellers to which this paper immediately appertains, but the *principle* is the same; and on the ocean it establishes that main that principal fact, which the small model in the Polytechnic Institution under all its disadvantages also fully bears out—'*equality of speed*,' even in these early and imperfect essays. In the '*quarter*' propellers applied to this model will be found, a more direct and faithful adherence to nature's prototype, and in their rapid rotatory action in the water, under the most favourable angle of incidence the blades display, the combined powers of wedge and screw. No back-water ruffles their silent course. A gentle undulatory ripple marks the tract described by each propeller, similar almost to that which follows the action of the tail of a fish when swimming rapidly near the water's surface. The same obedience to the helm with equal facility of backing astern may also be observed, and in case of accident to the rudder, the power of steering is practicable by their alternate and combined actions."

Eastern Counties Railway.—On Wednesday the 7th ultimo, the first stone of the New Bridge over the river Chelmer, in the parish of Springfield, about to be erected to connect the embankment of the Eastern Counties line, which has been some time in the course of formation, and which is now traversed by means of a wooden viaduct, was laid by Mrs. Braithwaite, the lady of John Braithwaite, Esq., the engineer-in-chief to the company. The design for the bridge is distinguished by that neatness which characterizes those already erected upon the line, and will consist of three arches, each of 45 feet span. It will be 43 feet in height from the surface of the water to the coping. —*Kent and Essex Mercury.*

MESSRS. HANCOCK AND PETTIT'S PATENT RAILWAY TRAIN CONTROLLER.

(From the Railway Times.)

Fig. 1.

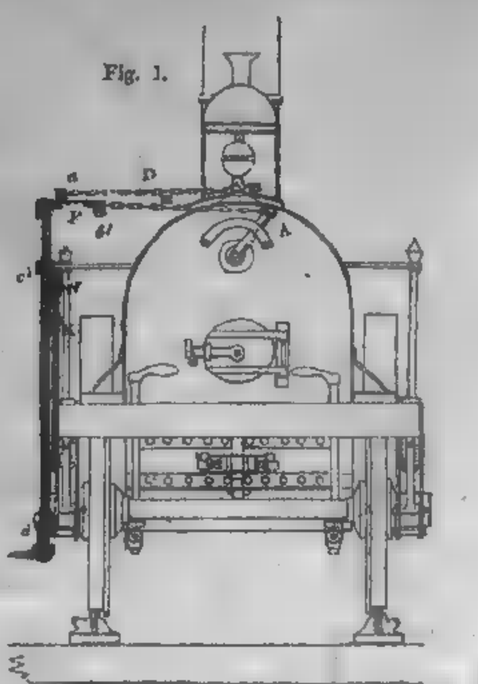


Fig. 2.

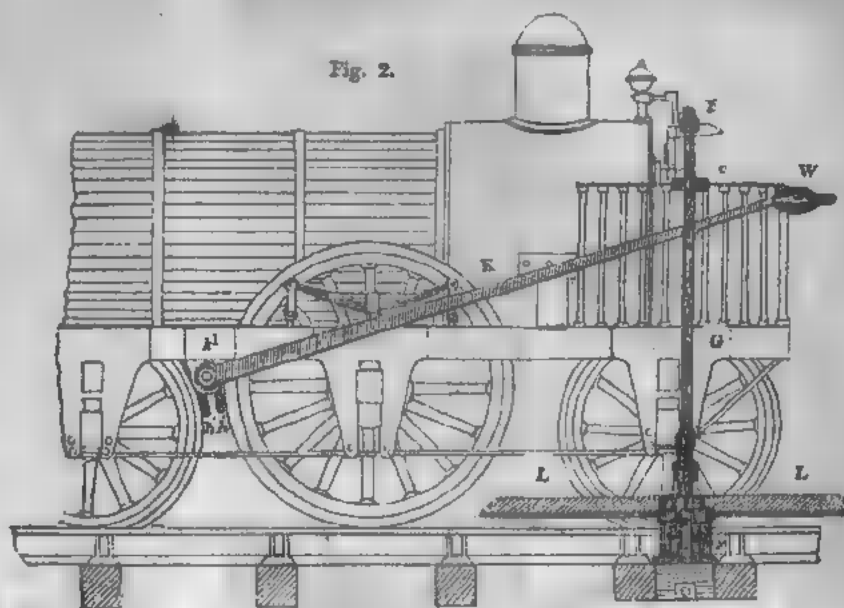


Fig. 3.

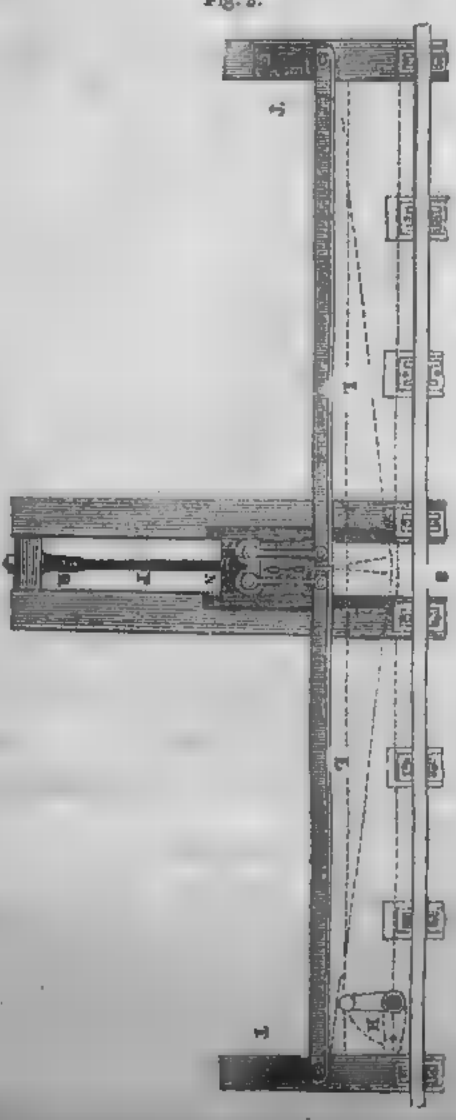
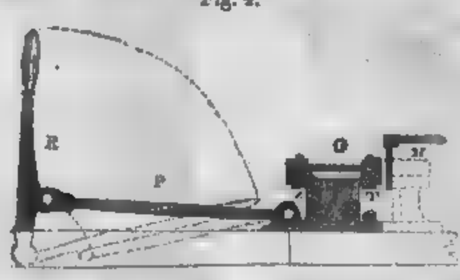


Fig. 4.



The invention* is described as consisting in "certain mechanical contrivances and arrangements, by means of which common railway trains running upon railways of the ordinary construction, may be always brought to a stand without the agency and independently of the will of the engine-driver, guard, or other person or persons thereon, or travelling therewith, and at any given distance from a station or at any part of a line where it may be deemed advisable to have such independent means of stoppage provided."

The "mechanical contrivances and arrangements" divide themselves into two branches, the first including those which relate to the engines and carriages, and the second those which relate to the roadway.

I. The additions proposed to be made to locomotive engines for carrying this plan into effect are represented in the accompanying engravings, figs. 1, 2, 3, and 4.

Fig. 1 is an end elevation of a locomotive engine with the apparatus attached, and fig. 2 is side view thereof; fig. 3 is a plan of one of the rails and apparatus attached on the ground, fig. 4 is a side view thereof. A is the handle of the steam regulator, and B is the handle of the steam whistle. These handles are each fitted with loose collars, but so as not to interfere with the common mode of using them by hand; each collar has a projection to which the ends of the chains D and E are attached respectively, F is a horizontal lever fixed upon the spindle G, carrying the pins *a* and *b*, and to the two loose collars on these, the other ends of the chains are connected in like manner. The vertical spindle G is secured near the top by the bearing *c* fixed on the projecting rail; from this it descends through the eye *d*, attached to the guide plate of the axle on which it is supported by a collar, and *H* is a crank lever fixed on the lower extremity.

"When the engine is running, and the whistle shut, the several parts described are in the exact position shown in the drawing, viz. both

* The patent is in the name of Mr. Pettit, but Mr. Hancock and Mr. Pettit are joint proprietors of the patent right.

the chains D and E strained tight, and the crank lever H standing out at a right angle to the side of the engine.

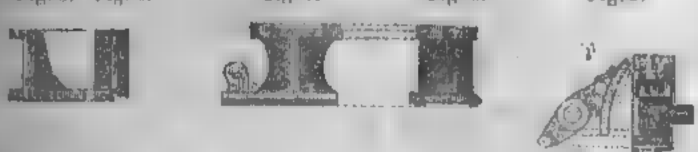
"Now, it is obvious that by fixing any apparatus on the roadway outside of the rails, by means of which the lever H may be pressed against, as the engine passes, to the extent of turning it about one quarter of a revolution, which will cause the two chains D and E to move with it, the steam will be shut off from both the cylinders, and simultaneously turned through the whistle.

"It may be proper, however, here to point out, that although the steam regulator, and whistle handles A and B, are connected to the lever F by chains, yet those handles can be worked by hand independently, either for the purpose of shutting off or putting on the steam to the engines, or blowing the whistle in the usual manner, leaving the crank lever standing in the position of fig. 1.

"Rods sliding in tubes on the principle of the telescope, admitting of the requisite contraction and expansion of the intervening distance, may sometimes be found convenient substitutes, for the chain D and E or any other suitable contrivance may be employed. A vertical instead of a horizontal action may be given to the lever by fixing it on a short horizontal axis, connected to the top of the spindle G by a small pair of mitre wheels, and supporting it by bearings fixed upon the most convenient part of the engine or carriage, or by any other mechanical means as circumstances may require."

II. The apparatus proposed to be affixed to the roadway to act on the combination of levers which has been just described, is also represented in figs. 1, 2, and 3, and in further detail in figs. 5, 6, 7, and 8.

Fig. 5. Fig. 6. Fig. 7. Fig 8. Fig. 9.



"There are four sleepers of sufficient length to extend from under the line of rails to receive the apparatus fixed upon them in the manner shown in the fig. 3. Upon the two outside ones are bolted the blocks T T, of which figs. 5 and 6, represent an end and side elevation. The two middle sleepers are connected together about a foot asunder by the cross piece, and they form beds fortified with plates for the carriage N to slide upon; figs. 7 and 8, represent an end and side elevation of this carriage, showing two ribs cast upon the bottom to drop between the beds for the purpose of keeping the carriage in a proper position, during its backward and forward travelling motion. L L, are two pieces of strong angle iron, though any suitable material and form may be employed, which move on entire pins, fixed in the top of the blocks T T, while their other ends rest upon the end of the sliding carriage N, to which they are coupled by links O O, moving on centre pins fixed in the back end of the carriage N. One end of the rod P is received by the jaws cast on the carriage N, in which it moves freely upon a pin, and the other end is forked, and forms a movable joint with a piece or tongue projecting from the edge of the lever R (see fig. 4), and the fulcrum of that lever is fixed to the cross timber morticed into the sleepers, fig. 3. By joining the connecting rod P to a piece projecting from the edge of the lever R, the lever and rod, when the lever is put down will form a line occupying the position marked by the dotted lines in fig. 3.

"In the position in which the apparatus is shown in fig. 3, the pieces L L, or the slants as they may be termed, are parallel to the rail S; and, of course, stand clear of the crank lever H, which is carried by the engine (see fig. 1), but when it is necessary to act upon the lever H, in order to stop the train, the lever R must be depressed, which operating on the sliding carriage N, through the intervention of the rod P, advances or thrusts it forward together with the centre ends of the slants L L, towards the rail S to the extent of the dotted lines (see fig. 3), which are then in the position to act upon the crank lever H, when brought into contact by the advance of the engine.

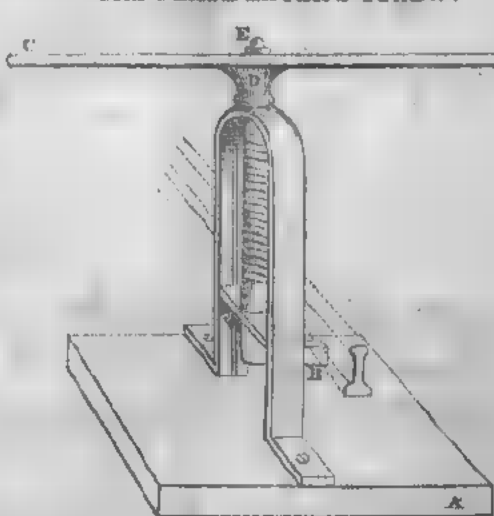
"The break lever K, figs. 1 and 2, moves inside of, and is suspended when out of action on, a projecting stud, inserted in the vertical spindle G. W is a weight to increase its power, or a spring to press upon the lever may be employed for the same purpose; this lever is fixed upon a short spindle passing horizontally through, and having its bearings in two plates, K, bolted to the engine frame, one within and the other without; of these, the outside one only, *k*, is visible in fig. 2, and upon the inside end of the spindle is fixed a short cross lever, the position and form of which is shown by figs. 8 and 9. The ends of this lever, K, bear upon the breaks *h h*, when the lever K is down, but each end has two cross pins under the straps *l l*, secured and screwed on the breaks for lifting them off the wheels on raising the lever K. These breaks are brought into action by lowering the lever K, occasioned by the removal of the supporting stud on the vertical spindle G, which is effected when that spindle is turned by the crank lever H, coming into contact with the slants L L in the manner before described."

The machinery last described is stated to be as applicable to the breaks, attached to the different carriages in a train, as to the locomotive engine; "especially upon such breaks by means of a spindle similar to the vertical spindle G, in the manner before described."

The lever R that brings the stationary apparatus into use may be worked by hand by any of the policemen stationed on the line, or other person appointed for the purpose.

The claim of the patentee is as follows:—"I declare that though I have specified under this head those contrivances and arrangements by which I think the objects in view may be best accomplished, and mentioned also certain contrivances which may be substituted for some of those so preferred by me, I declare that I do not confine myself to the precise arrangement and construction of the parts shown, as they may be varied under different circumstances without departing from the nature of my invention, but I claim a right to all variations and modifications of the same, and to all substitutions of equivalent means, either in whole or in part, by which the like effects may in the same general way be produced. And I declare, that what I claim generally is the addition to railway engines and carriages of such a combination or system of levers connected with the steam cylinders, alarums, and breaks, that being acted on in the direction of the line of motion, they shall simultaneously, or nearly so, shut off the steam, sound the alarums, and bring the breaks down on the wheels, and also the fixing to or placing on railways of an apparatus such as that before described in such a position that it can be made to act on the said levers in the direction of the line of motion, (by some projected part or parts thereof) without the agency, and independently of, the will of the engine-driver, guard, or other person or persons on the engine or train required to be stopped. And I claim both of the mechanical means, or system of means, last herein generally claimed, whether used together or used separately, that is to say, whether both are used together as I have described, or one of them only in combination with some other and wholly different means, or system of means, from that which I have specificed."

THE PLATE-LAYER'S SCREW.



Sir—If the above rough sketch of an instrument for lifting the rails, &c. on a railway, for the purpose of repairs, be thought of any service to you or others, for whose assistance it was contrived, (the plate-layer), you are at liberty to use it in any way that you may consider it deserves. The instrument is now generally used among the plate-layers on the "Great North of England Railway," near York, and is found to answer the purpose exceedingly well. The bottom A, is inserted sufficiently below the bottom of the rail until the claw B, can be applied under the rail, when the instrument is screwed up by the handle C C, lifting the rail and blocks at the same time, when high enough, the plate-layer or repairer commences beating the under side of the block solid. The female screw is in the base of the cross lever at D.

Your's, &c. M. Q.

York, April 9, 1841.

THE ARCHITECTURE OF LIVERPOOL.

Sir—In the outset of my remarks on this subject I avowed my intention of preserving, to the best of my ability, a spirit of candour and impartiality; and I should feel that I was very far from acting up to this pledge did I not endeavour to make the best amends in my power for any injury or injustice which, however unintentionally, may have been done to the works noticed, or their authors. Overlooking under the circumstances, the acrimony of expression employed by Mr. Corbett, in his letter published in your last number, and giving, as I feel bound to do, the fullest credit to his disclaimer of having taken any unfair advantage in carrying out his design for the North and South Wales Bank, by examining those of his competitors, I claim from him credit for equal sincerity, when I declare that no idea was ever farther from my mind than that of sheltering myself under a saving clause, for the purpose of asserting any thing of which I doubted the truth. I further assure him that it gives me unfeigned pleasure to find him so entirely denying the charge, and that I sincerely regret having given publicity to such an imputation, which however, I must in justice to myself be permitted to say, would never have been the case had not the report obtained such general credence among those interested in the matter, as left me, as I then thought, no ground for doubting its truth. As regards the committee, the case is by no means so clear; and without intending in any way to connect Mr. Corbett's name with proceedings of which he professes entire ignorance, I maintain that judging from his building as executed, and from the designs he submitted in two later competitions in this town, as compared with the known ability of several of the competing architects, it is difficult to conceive how, except by the exercise of some private influence, the decision of the committee should have been unanimous in his favour. Competition committees, however, are in their movements among the most eccentric and inexplicable of bodies, and it is vain to attempt arguing on their sources of action by the rules commonly applicable to organized matter.—With respect to the limits of cost, and the time the plans were in the hands of the committee, I spoke to the best of my knowledge and recollection; and still think that part of the designs at least were six weeks in their possession, and that the sum of 5000*l*. was *named* as the proposed amount of expenditure, but I suppose from Mr. C.'s plain assertion, not so advertised.—My mistake as to the position of the back wall of the portico, arose from the view obtained through the open doorway, of the wall of the vestibule next the bank; and such is the confusion of lines, arising from the number of features which are crowded into this narrow space, when seen in passing close to the front, as was the case with myself, that the most unequivocal impression remained on my mind that the case was as I stated it; and I was not singular in this idea. The door is now I see in its place, and this deception is corrected; but the pediment, which, as Mr. Corbett will perceive on reference, I mentioned as *principally* marking the obliquity of plan, remains unalterable, and its effect in this respect is most undeniable, as any one may prove by trial with a block model. I hold my first opinion as to the waste of valuable space caused by the use of columns and pilasters; and though the privilege of advancing the bases a few inches over the footway had at the time slipped my memory, the fact is certain that *room is sacrificed*, and the public thoroughfare contracted, for the purpose of employing a mode of decoration most unsuitable for a building of such proportions, and by this means cutting it up into a series of narrow strips, into which the necessary openings must be crammed as they best may.—If Mr. Corbett acknowledges, as by his silence on that point he in substance does, that the sketches sent you are fair representations of the proportions of his building, I may safely leave the question of its merit in point of design to the judgment of your readers; and trusting that the "judicious Eder," and the "many" admirers mentioned by Mr. C. may long remain the sole advocates of such a style as the Bank exemplifies.

I remain, Sir, your's obediently,

H.

Liverpool, April 12, 1841.

ON THE EMPLOYMENT OF MILITARY ENGINEERS.

Sir—The perusal of the article in your last number on the subject of the employment of military engineers in positions to dictate to the civil professional practitioners, has called into expression my own long dormant feelings upon a very similar subject.

It has been my lot to have had the means of observing, rather intimately, the working of the civil engineering and architectural operations of the Ordnance and Admiralty departments of the public service, upon which subject I beg permission to offer a few remarks.

It is well known that a set of young gentlemen dignified with all the notions of embryo-officers, are drilled through what is called a "*course of civil architecture,*" under the auspices of a *colonel* at the Royal Military College at Woolwich. When lectured through this educational course, under the instruction of their Military Commandant, and made very clever in copying drawings, they obtain their Lieutenant's commission, and become at once, and as a matter of course, endowed with the necessary qualifications for designing and executing all the details of the civil engineer and architect's profession. They are stationed at an out-post under a staff of colonels and captains, and are expected to make drawings, measure artificers work, abstract, price, and enter into all the minutiæ of a civilians practice. They pretend to great efficiency and usefulness, and are very apt in signing at full length their names and designations to the designs, &c. of which they are supposed to be the authors. But it happens that to every station there is attached an humble ill-paid individual usually emanating from the carpenter's bench, and rising through the grade of Foreman, to what is called the Clerk of Works. He and he alone is really the designer, the estimator, and measurer, the every thing but the signer. He, though generally himself most incompetent to perform the lowest duties of the architect's profession, is yet sufficiently in advance of his military masters to do all the work for which they get the credit. With all the innate idleness of military men, added to a professional pride which raises them above the indignities of actual practice—with no inducement to, and no necessity for, that incessant application to details which can alone impart information and lay the ground work of professional acquirement, they saunter through the subordinate ranks, till at once getting the rank of colonel of engineers, they are fit for any thing!

Barristers of 20 years standing, whether they ever held a brief or not, are duly qualified for most things, but a colonel of engineers beats them hollow, their very rank endows them with that excellency of skill, that pre-eminence of knowledge, that loftiness of science which marks them as the class by which not only the public departments connected with civil engineering and architecture are to be controlled, but from which commissionerships of all sorts are to be formed to discipline—to dictate to—and to degrade—men, whose individual energies have done more to elevate their country in the scale of nations, and whose efforts have been more successful in developing its resources, and in promoting the industrial happiness of its people, than those of any other body, of whatever class, or of whatever pursuit.

At this moment we have a captain of engineers at the head of the architectural and civil engineering departments of the Admiralty, a man who alone and unassisted is incompetent to execute with decency the most ordinary architectural performance—a man who has only the most general smattering of architectural knowledge, who, if he had to pass an examination, with an attentive pupil of four years standing, would be disgraced; and yet this man is at the head of a department in which hundreds of thousands of the public money are annually expended.

But perhaps it will be said he is only the director-general, in whom a tact in the management of business, and a soundness of judgment upon ordinary subjects, is more important than the knowledge of professional detail. He who knows most of his profession most highly, values this description of knowledge—but be this as it may, let us see who are the working men. At nearly every dockyard there is stationed a resident lieutenant or captain of engineers, one of the class before alluded to, who lords it over a few foremen, and perhaps a clerk of the works. These men have no practical acquaintance with the value of materials or the cost of labour, their knowledge is confined to the experience of government work, and they are under the necessity of confiding in persons whose direct interest it is to abuse their confidence, and to make the most advantageous bargains for themselves. If competition be had recourse to, it is well known that contractors who have to deal with men ignorant of the usages of private business, and from that ignorance open to abuse, have a thousand ways of taking advantages which the experienced practitioner would readily detect.

Why should not these military architects and engineers be called upon to submit to public examination before their appointment? I know of one of these functionaries who, when first appointed to conduct works amounting to from 12 to 20,000*l*. a year, was unacquainted with the commonest professional terms. The candidates for country engineers in Ireland have to pass a severe examination. The candidates for private employment are constantly subject to the test of severe competition, and why is the same course not adopted with respect to these mighty men? Does their rank oppose so insufferable an indignity? or does it not signify whether they be qualified or not?

Z

since if they fail, if they squander the public money, its *only* the public who suffer, and nobody feels it.

It may be asked what is the practical evil of all this? Some of the evils which I have observed are, that the director of works puts himself under obligations to the more experienced builder for the information which he lacks; deplorably ignorant himself, he draws from him his ideas, and gets into the habit of *depending upon* the very man whom he should be in a position to *direct*. One result of this is, that money is wasted in useless strength, or in the adoption of expensive methods and expensive materials. The self-styled engineer feeling no confidence in his own knowledge, and desirous above all things to avoid the onus of a failure from want of strength, is induced to lavish expenditure in the attainment of security beyond all necessity, and even beyond all decency. And so our government works instead of deriving all the benefit of the experience of private undertakings, are usually conducted in a manner altogether in arrear of the knowledge of the times.

Instead of employing persons competent to design public works, and well acquainted with the most advantageous mode of getting them executed. If any matter demanding superior skill be required, such for instance as a swivel bridge (as was recently the case in the Plymouth Dockyard), a manufacturer is invited to submit his *design* and tender, and the work costs 40 per cent. more than it would if competition tenders had been called for upon a specific design. But who is to make that design? how is it to be had if the persons employed in the engineering department, whether chief or subordinates, are incompetent to its production? and if incompetent to such a work, how fit are they for the office which they hold?

How does it happen that these things are so? That the most competent man that can be found as the Surveyor of the Navy, whose office it is to construct ships, and to make drawings, and enter upon all the elaborate calculations required in such an important work, is *not* a profound mathematician, who having great mechanical skill, and having directed his entire education to that pursuit, is well informed upon all its manifold mysteries—*not* a practical ship builder who, having a scientific mind, and gifted with intelligence beyond his fellows, has attained the theoretical and mathematical knowledge which forms the necessary qualifications of an accomplished naval architect—*not* either of these, but a *Captain in the Navy*, a man who knows as well how to build a ship, as a prince does a palace, or an archbishop a cathedral. Many gentlemen who have always lived in good houses, and noted their conveniences or defects, fancy themselves very skilful in arranging the apartments of a mansion, and sufficiently knowing for all the measure of taste that they think necessary for its embellishment; they build after their own designs, and under their own management, and whether *they* find it out or not, all their friends discover that their deep solicitude for some darling "bijouterie" has spoiled their house, that they have sacrificed their comfort and their purse to their conceited notions: and yet the Captain in the navy has lived in a ship from his boyhood, has noted all its good or bad points, and is not he the man to build a ship? he may build and he may alter, and he may be very successful in attaining some one point of excellence, but at what cost? let the naval expenditure tell, and it *could* tell some very deplorable tales upon this subject; it could tell at what *cost* the country has progressed with the education of our Captain-Surveyor, what has been paid for his experience, and how dearly we ought to prize it. This, Sir, is part of a system which is overrunning all the departments of the public service, we are becoming a military-ridden people in matters essentially civil. Naval and military men hold together and assist each other to the degradation of all the branches of the civil service. Their rank is a passport every where, and gives them a position which is not readily yielded to civilians, of whatever merit: existing upon patronage, they nurse it and cherish it as their best friend, and whatever of it they have to disperse, they take good care that it shall flow into the prescribed channel of their own order.

I do not expect that writing upon this subject will be of much practical utility, and I hate agitation, but it is high time that some notice of so wide-spreading an evil against the profession which your Journal so ably upholds, should find a place in its columns. It is the more important that it should do so now, that we are told by the President of the Institution of Civil Engineers, that too many young men are crowding into the profession, which is overstocked with professors, while the field of their employment is diminishing. It may well indeed diminish, while the government departments overlooking the claims of men whose professional education has cost *them* seldom less than 1000*l*. are put aside by military pretenders, who after a few months dabbling in drawing, under the masters of the Royal College, are turned out finished, and fit for the best of every thing.

Verily I wish there were a tribunal at which these belted aspirants could take a tilt with *working men*. I would have them set alone, not even should the despised clerk of works lend his wonted and bashful glance—he should not only *sign* the design, but he should make it, and a very pretty business he would make of it.

Having brought my military professors into this predicament I am quite content to leave them there, and subscribe myself,

A CIVILIAN.

RIVER SEVERN.

Report on the Proposed Improvement of the River Severn, between Gloucester and Stourport.

By WILLIAM CUBITT, Civil Engineer.

THE object of this report is to set forth the proposed plan and probable cost of the intended improvement in the navigation of the river Severn, from Gloucester to Stourport, agreeably to plans and sections lodged with the respective Clerks of the Peace, preparatory to an application to Parliament in the ensuing session for that purpose.

In its present state the river Severn abounds with shoals, which very much impede the navigation, so as to render it impossible for the vessels which navigate it to proceed with full cargoes, or in a long continued drought to proceed along the river at all, to the manifest disadvantage of all that portion of the public which has any interest in or dependence upon the navigation of the river Severn.

The object of the proposed plan is to obviate these difficulties, and to obtain a minimum depth at any time of not less than six feet of water in all parts of the navigation between the entrance lock of the Gloucester and Berkeley Canal, at Gloucester, to the entrance lock of the Staffordshire and Worcestershire Canal, at Stourport, and upon such principle as will in no wise interfere with the due and proper drainage of the adjoining lands, or the discharge of the flood water of the river as at present, except insomuch as both may be improved and facilitated by the measure.

The means by which this improvement is to be carried into effect, is by what are technically termed weirs and locks, of which there will be five of each between Gloucester and Stourport.

The effect of the weirs or dams in the river is to divide the whole fall of the low summer water between Stourport and Gloucester, into five steps or falls, and by a side cut or short canal (with a lock therein) round or past the side of the weir, the navigation is carried on in the same manner as in an artificial canal, whilst the river passes off over the weir at a depth or thickness proportioned to the quantity of water coming down, and the weir is so contrived as to height, length, and position, that whilst it will never let out the water of the river below the fixed navigable depth in time of short water, it will nevertheless afford a greater capacity for the escape of flood water than at present obtained in the same place; and as all the shoals in the river between the weirs are to be dredged out to make a uniform navigable channel, it must be evident that the capacity of the river for the discharge of floods must be increased and improved, whilst through the same means the low summer water will be prevented from running off below its present level at the foot of each weir; and from the low water channel being deepened at the shoals, the exit of the drainage water will be improved also, whilst the navigation will be at all times available whether it be drought or flood.

The total fall of the river at summer water, from Stourport to the entrance of the Gloucester and Berkeley Canal, is thirty-two feet in a total distance of forty-two miles, of which the lower portion from Gloucester to Upton Ham, (the site of the first weir), being a distance of eighteen and a half miles, the fall is only four feet, a quantity but little more than sufficient to carry off the water in the ordinary state of the river, the whole of which distance being subject to the influence of the tides, no weir or locks will be required within these limits, (that is, from the Upton weir downwards), and no other operations than dredging and regulating the breadth of the low water channel, to obtain the requisite navigable depth, will be necessary; and it may be further observed, that no dredging or deepening of the channel will be done on the Gloucester branch of the river below the entrance of the Gloucester and Berkeley Canal, or on the Maisemore branch lower down than the entrance lock to the Herefordshire Canal, and to no greater depth than the sill of that lock, and of sufficient breadth to admit the boats which navigate it to pass to and from that canal and the river at the Upper Parting respectively; by which means, and leaving untouched the remaining portion of both branches below the entrance to the Berkeley and the Hereford Canals respectively, it must be evident that no alteration will be made in the height or level of the surface water of the river up to the first weir in a distance of eighteen and a half miles above Gloucester; nor is it intended or required by the present proposition for obtaining a six feet navigation to erect any weirs or locks, or to do any works that may affect the height or level of the river below the weir at Upton Ham, or in any way to affect, alter, or interfere with the adjoining lands in relation to the river as at present existing.

Proceeding upwards, the next weir and lock are at Worcester, just below the entrance lock at the Birmingham and Worcester Canal, at Diglis, a point twenty-nine miles up the river from Gloucester; the third weir and lock will be Bevere Islands, four miles above Worcester, at a place where the river has two channels, in one of which will be placed the weir, and in the other the lock, by which the necessity for an artificial canal or side cut will be avoided.

the fourth weir and lock will be just above Holt Bridge, three miles and three quarters above No. 3; and the fifth and last, at Lincomb Hill, four miles and a quarter above No. 4, or just forty-one miles from the entrance to the Gloucester and Berkeley Canal at Gloucester, and one mile and a quarter below Stourport Bridge, making a total distance of forty-two miles and a quarter for the improvement of the river, and making a minimum navigable depth of six feet over the lock sills, without raising the usual summer height of the water in the river at the tails of any of the locks and weirs, or causing any obstruction to the passage of flood waters.

Such is the mode by which it is proposed to improve the navigation of the river Severn, and which may be more fully understood by a perusal of the plans and sections as deposited with the Clerks of the Peace, in which the details of the measure, as required by the standing orders of Parliament, are clearly and correctly laid down.

Adverting, however, to a meeting of the land proprietors along the Lower Severn, (viz. from Worcester downwards) held at Tewkesbury, on the 16th December, and a meeting of the parties interested in the navigation of the river Severn, held at Gloucester, in the evening of the same day, at both of which I had the honour of attending, and giving such verbal explanations of this measure as were then and there required; and with reference also to certain resolutions which were passed at those meetings, and at a subsequent meeting of the committee of landowners, to the purport generally of requiring more definite information in writing from the promoters of this measure, as to the nature and extent of the proposed works, and every particular connected with the undertaking, as regards not only the nature of the works, but also the constitution of the Association for carrying them into effect, and the amount of tolls to be levied for defraying the cost, and maintaining the undertaking, &c., it may be observed, that there are some points, perhaps, out of my province to answer.

In addition, therefore, to what has been explained already with regard to the nature of the works, it may be satisfactory to the parties making inquiries at the meetings above stated to state,

1stly. That there is no intention of taking land without consent of owners, along or on either side of the river, except at those parts shown on the plan as the situations of the locks and weirs.

2dly. That the weirs will be solid weirs, placed very obliquely across the river, and of such length that (with the requisite widening of the river at the spot) there will be a greater water way on any cross section of the river at the weir after its erection than before.

3dly. That the height of the weirs, as shown on the sections, will not raise the water in short-water seasons above the present summer level at the site of each weir next above respectively; and the depth of water to be maintained by dredging, is a clear six feet below a horizontal line extending up the river from the top of each weir respectively.

4thly. The locks are proposed to be not less than one hundred feet clear length within the chambers, nor more than twenty feet in clear width, with six feet water over the sills in low summer water.

5thly. The estimated cost of the works from Gloucester to Stourport is £150,000, of which, as nearly as may be, one moiety will be expended between Gloucester and Worcester, on a distance of between twenty-nine and thirty miles, and the other moiety between Worcester and Stourport, a distance of thirteen miles, or thereabouts.

6thly. As regards the tolls to be imposed, to meet the above expenditure, maintain the works, defray the current charges of management, and (as should be contemplated) raise a fund to pay off the original cost in course of time,—that is probably a question more suited to the committee of management than the engineer; the question, however, is in very narrow limits, and assuming the minimum annual amount necessary to be raised for the above purposes, of interest, management, and maintenance, to be £10,000, and which, in my judgment, would be but just sufficient without paying off any capital, it follows that the amount of tolls per ton must depend upon the quantity conveyed along the river both ways, between the three principal points (Gloucester, Stourport, and Worcester) respectively. Taking, therefore, the charge per ton from Stourport to Gloucester to be double that from Worcester to Gloucester, and assuming the minimum charge for the long length to be sixpence per ton for the whole distance, it will require 270,000 tons between Stourport and Gloucester, at sixpence per ton, and 260,000 tons between Worcester and the other two points respectively, at threepence per ton, to raise £10,000. But as various contingencies may arise tending to increase the annual cost, or to diminish the amount of tonnage; and as a liquidation of the first cost ought never to be lost sight of, I strongly recommend that powers should be taken to fix a higher toll than sixpence and threepence per ton for the whole and half distances respectively, and am of opinion that one shilling per ton for the whole distance, and sixpence per ton for the Worcester half either way, should be fixed as a maximum, beyond which the commissioners should not have the power to charge, and that sixpence and threepence should be the minimum below which the tolls should not be reduced till such time as the first cost of the works be either funded or paid off; and if provision were made that an additional sum were funded before the tolls be reduced, the interest of which would serve for wear, tear, and management, the river in its improved state might be looked forward to as becoming in time a *free navigation*.

7thly. Touching the constitution of the managing body, all I can offer on that head is an opinion many times urged on other parties when attempting to form a company for improving the navigation of the Severn, viz. that the improvement of this navigation should be carried into effect by commissioners under an act of Parliament, as a public rather than a private measure, and in such manner that the profit or emolument to be derived from the measure, should eventually go towards the reduction of tolls, and rendering the navigation free instead of being made private gain or individual speculation.

W. Cubitt.

London,
January 5, 1841.

Report to the Committee of Management of the Gloucester and Berkeley Canal, by W. Clegram, Engineer.

Gentlemen—In compliance with your instructions, I have carefully examined the plans now proposed for improving the navigation of the River Severn, from Gloucester to Stourport; and with the explanations which I have received from Mr. Cubitt, the Engineer, by whom the works are projected, I am enabled to report my opinion upon the subject.

It is most certain that the interests of the Gloucester and Berkeley Canal Company are deeply involved in the measure—few have more to gain, or more to lose, from the success or failure of it, than the Canal Company; and instead of confining my attention simply to the engineering department, I have endeavoured to take a general view of the whole subject, in order to ascertain what are likely to be its effects upon the welfare of the canal.

To come to a right understanding of the matter, it should be known, what are the existing inconveniences in the navigation of the river, and what would be a sufficient remedy.

The obstructions to the *free* navigation of the Severn, arise from two causes, viz.: from too *great* a quantity of water in time of floods, and from too *small* a quantity in the summer season. The former is without a remedy. And it is to supply the deficiency of the latter that the plans of the "Severn Navigation Improvement Association," are proposed as a remedy. This deficiency of water is felt on an average, during three months in the year; and it is the opinion of nearly all the traders on the river, that, if a depth of four feet, or four feet six inches of water could be maintained throughout this period of the year, it would fully meet the wants of the trade.

To remedy these impediments, and meet these requirements of the trade, the "Severn Navigation Improvement Association" propose to obtain a depth of water in the river, throughout the dry summer weather, of from seven feet, to seven feet six inches between Gloucester and Worcester, and a depth of seven feet between Worcester and Stourport, by plans so nearly similar to those last proposed, and described in my report of the 12th December, 1837, that I need not here recapitulate the particulars, but merely state, that, it is to be effected by dredging away the shoals in the river between Gloucester and the first dam, which is situated just below Upton-upon-Severn, about eighteen miles and a half above Gloucester. This dam will carry the proposed depth to Worcester; and between Worcester and Stourport there are to be four other dams to give the depth of water to Stourport. The dams are to be passed by side cuts and locks. The locks are to be 100 feet long, 20 feet wide, and with six feet of water over their sills. The dams are to be solid, entirely across the river; but placed so obliquely across the stream as to offer the least possible obstruction to the passage of the flood waters. The entire cost is estimated at 150,000*l*. The maximum toll is proposed to be 6*d*. per ton from Gloucester to Worcester, and 6*d*. per ton from Worcester to Stourport; or 1*s*. per ton for the whole distance; to be equally levied upon the goods conveyed by all classes and description of vessels throughout the whole year. And the works, in execution and subsequent management, are to be placed under the control of Public Commissioners.

This is the plan proposed; and I cannot say that the opinion I have formerly expressed on the engineering defects of a former and similar plan is in the least degree altered with respect to this—for I consider it, as I did the other, inapplicable to any river similarly constituted with the Severn. For from the mountainous rise of the river—its rapid and precipitous course throughout a considerable portion of its length—from the accumulated waters of several rivers being poured into it, and thus being the drain of a very large extent of country,—its waters are not only highly charged with silt held in suspension in them, but vast quantities of gravel and heavy materials are brought down, and rolled over the bed of the river in a continuous stream. Any interference therefore (as would be the case by the plan proposed) with the bed of the river, that would destroy its natural powers of cleansing itself, must necessarily entail a heavy and constant expense to provide artificial means to get rid of the accumulations—for with the tidal deposits on the one hand, and the land flood deposits on the other, the accumulations will be very great. I have not documents by me to refer to, but I believe the late celebrated Mr. Telford, when employed about the year 1824 or 1825 to offer some plan for the improvement of the navigation of the Severn, gave a similar opinion to my own. I know that he recommended the formation of a canal between Gloucester and Worcester, at a cost of 200,000*l*. which he was not likely to have done, had he considered the river capable of economical and permanent improvement.

But setting aside these engineering difficulties, there can be no doubt that the proposed works are on a much larger scale than is needed. The depth of water over the outer sill of the Gloucester and Berkeley Canal Lock at Gloucester, during the low summer water, being from 4 feet, to 4 feet 6 inches only, is quite the index of what the depth should be in the river; for it is clear, that vessels loading in the canal for the river, would not be loaded to a greater depth than that of the water over the sill of the lock through which they must pass; nor would vessels coming down the river at this season (however great the depth of water that might be obtained in the river) be loaded to a greater depth, and thus be subjected to the delay and inconvenience of the transhipment of a part of their cargoes before they could enter the canal. As a proof that the trade requires no greater depth than this, I may mention, that it is indeed a rare case for even the largest trows to be

loaded, at any season of the year, to a greater depth than 4 feet, or 4 feet 6 inches, for navigating the river above Gloucester; and if it be said that this arises from the want of water, I would reply, that if it were more convenient or economical to sail these craft at a greater depth, it would surely be done during the nine months of the year when the depth of water is ample for it. I feel satisfied that if a depth of 5 feet, or 5 feet 6 inches at the most, of water, could be obtained, and maintained during these three months of the year, it would, for the considerations above set forth, be found fully sufficient. In this case, the whole of the works, the dredging, the dams, the locks, the cuts, the equalization of the area of the channel, all might be proportionately diminished, and performed at a considerably less cost. In dredging alone, about 150,000 cubic yards might be saved, (being upwards of one-half the whole quantity at the 7 feet 6 inches depth,) and the annual cost of management and maintenance would be much lessened; and I think it probable, that this diminished plan might be done and upheld at a cost that would not require the imposition of more than an equivalent toll for the benefit conferred upon the trade. The toll necessary to pay the interest on the money to be expended in carrying out the larger plans of the "Severn Navigation Improvement Association," and in upholding the works, I should fear would press very heavily upon the trade, especially as it would be levied throughout the year upon all classes of vessels, the greater part of which, from their light draft of water, would derive a comparatively small advantage from the measure.

These are weighty considerations for the Canal Company; and if it be, as I have frequently heard it advocated at your board when any suggestion has been made to raise the tonnages of the canal, that the smallest additional imposition of toll on those articles which form the bulk of the trade upon the canal would be ruinous to it, the same effect would result from the imposition of any toll for navigating the river, if it exceeded the limit of the loss sustained by the trade from the impediments existing in the navigation of the river.

The only other points that I have to allude to are—1st, that the notices of the intended application to Parliament are for power to improve the river from the *Lower Parting* upwards, whereas the deposited section shows an interference with the river only as low down as the lock of the Gloucester and Berkeley Canal in one branch, and the lock of the Hereford and Gloucester Canal in the other branch of the river. At the meeting with the promoters of the measure on the 16th of December last, an explanation of this discrepancy was asked, and it was replied that there was no intention to touch the river below the points above named, neither would they obtain power in their Act to do so. Secondly, the removal of the Maisemore shoal, in the Over branch of the river, to the depth shown in the section. This shoal, it was pledged, should only be removed to the depth and width necessary to accommodate the vessels navigating the Hereford and Gloucester Canal. It is most important to the interests of your canal that the parties should be kept to this; for any interference with the shoals between your lock and the Lower Parting, and with the shoals in the other branch of the river, would seriously diminish the depth of water in the Gloucester branch of the river, and consequently over the sill of your lock, and ultimately render it necessary to place the sill at a lower level, which, if ever needed, will be a work of considerable difficulty and expense.

For the reasons above stated, I can neither approve the *mode* by which it is proposed to improve the navigation, nor the *extent* to which that improvement is proposed to be carried; believing the mode inapplicable to the character of the river, and the extent more than is required by the trade.

W. Clegram.

Saul Lodge, 5th January, 1841.

Report addressed to the Committee of the Gloucester and Berkeley Canal Company, on a Bill now in Parliament for the Improvement of the River Severn, By James Walker, LL.D., F.R.S., L. & E., Civil Engineer.

Gentlemen—Since I received your resolutions and the communications from Mr. Brickwood. I have given my attention to the plans and sections which accompany the application to Parliament for the improvement of the river Severn, with Mr. Cubitt's report in explanation of the scheme and its advantages, and also Mr. Clegram's report to you, with other documents and papers on the subject.

In December, 1836, Mr. Rhodes, the engineer to the then proposed Severn Improvement Company, accompanied Mr. Cubitt and me on a view of the river. There had been a high flood ten days before, and at the time of our view the water was from eight to ten feet above the summer level. Ever since I received such recent instructions as I felt justified to act upon, the floods have been still higher, so that I have not had the opportunity of seeing the river in its short-water or summer state which would have been desirable; and my report must be taken, with allowances for this disadvantage, as to knowledge of facts and otherwise.

Mr. Cubitt's Plan.—Mr. Cubitt's plan is well described in his report. It differs from that of Mr. Rhodes in his plan first deposited, when a ship communication to Worcester was intended, in leaving out the weir and works Mr. Rhodes proposed near Gloucester; in placing the first weir, that near Upton, about a mile higher up the river than Mr. Rhodes at one time proposed, and about three miles lower than Mr. Rhodes's last proposal, as I understood it from himself;* in placing a lock and weir below Worcester, and below the entrance of the Birmingham and Worcester Canal, instead of above that entrance; in placing the uppermost lock, that nearest Stourport, in the river, and the weir in the new cut, the reverse of Mr. Rhodes's plan; in increasing the length of all locks above Worcester from 90 to 100 feet, and diminishing the width from 24 to 20 feet. I observe also that the works are now to be executed, not by a Company, but an Association, and if this word be, as respects the objects, synonymous with Trust or Commission, I think the change of character a decided improvement, for the idea of locking up the Severn in the hands of a joint stock company always appeared to me very objectionable.

Trade of the River Severn.—The River Severn, from its position in reference to the Bristol Channel, from the very great length for which it is navigable, from the numerous canals that connect with it, and which supply the wants, and take off the natural products and manufactures of several of the most densely inhabited and richest counties, and from the great extent of country of which it is the great drain, is in point of importance inferior to scarcely any river in the kingdom. Below Gloucester the river suddenly spreads out to a great width, and partakes more of the character of an estuary, consisting of sandbanks and shallow, shifting, tortuous channels, and a lift of tide that is scarcely perceptible at neaps.

Hence, in its natural state, the Severn was not, without great danger and delay, navigable for many miles below Gloucester, but for the smallest description of vessels; Bristol was, in fact, the port of Gloucester. The Gloucester and Berkeley Ship Canal, which was begun by individual subscriptions in 1794, and which, through want of funds, might, but for the liberal loans from the Commissioners for the Loan of Exchequer Bills for Public Works, have been a ruin at this time, was opened in 1827, and has removed the above evil as high as Gloucester. Ships of very heavy burthen, say 500 to 600 tons register tonnage, are now docked close to the city, and an impetus has been given to the trade of the town and of this portion of the kingdom. In this dock by far the greater part of the ascending and descending inland trade is transhipped into or from canal boats and barges—the remainder is conveyed in Trows, which load chiefly at Bristol, pass through the Gloucester Canal, and go up to Worcester, thirty miles, or to Stourport, which is twelve miles higher.

Proposed Improvements.—It is upon the portion of the river between Gloucester and Stourport, that the improvements are now proposed, and notwithstanding my limited knowledge, I feel justified in saying, that whether as respects navigation or drainage, this river has been most grievously neglected, that it is capable of improvements, and that it ought to be improved. At present we have a river of the importance I have named, upon portions of which the track-path (if it deserve the name) is covered with water, so as to be impassable whenever there is any flood. In short-water time, again, the shoals are such, in many places, some even below Worcester, that a canal boat of 24 tons burthen, and drawing under four feet, the great trade of the river, cannot make certain of getting over them, but is liable to considerable delay. These shoals are local, and appear to consist of material which might be removed, and being removed, and the width regulated, would not be likely to return, as is proved by the deeper water, above and below the shoals; but even this does not appear to have been attempted.

Expediency of Improving.—On the expediency of some improvement there ought not, therefore, as I think, to be any difference of opinion. The questions are, to what extent, in what manner, and how the trade is to be taxed to secure the repayment of the cost of the necessary works? for without good security, either the funds will not be obtained to do what is required, or the terms will be unfavourable, for which the trade will, in the end have to pay. The idea of paying any thing upon a hitherto free river may not be more agreeable than the payment of tolls upon turnpike roads; but if the expenditure be judicious, and the toll equitable, the traveller who pays has the greatest benefit.

Proposed Depth.—Mr. Clegram thinks the depth proposed by Mr. Cubitt greater than the vessels that now use the river require; and his observations on the particular nature of the trade are entitled to great attention. But it is also to be remembered, that the size and draught of a portion, at least, of the vessels, those that load in the river, are limited by the capability of the river; that half the number of Trows go up with half cargoes, caused, I presume, in part at least, through want of water; and that greater capability would probably give rise to vessels of greater burthen, which at present it would be imprudent to construct. Again, the facility of navigating vessels of less draught than the greatest depth, even canal boats, is increased by having a good depth of water. The floods also go off more rapidly; and thus both navigation and drainage are improved. It is to be remarked, also, that in fixing the level of the lock and weir, which cannot afterwards be increased, Mr. Cubitt is obliged at once to calculate on his ultimate minimum summer depth. Therefore, although the depth proposed by Mr. Cubitt may be too much to execute at first, I think that nothing particularly below Worcester, ought to be done which will prevent the depth he proposes, when there appear occasion and funds for it. The argument, that the upper lock of the Gloucester and Berkeley Canal has only four feet to four feet six inches in times of drought, is good to an extent only, and is a question of inconvenience against expense. A lock of greater size might, I presume, be made, should the trade justify such an expenditure.

Stourport to Worcester, Effect of Weirs.—I also think that, from the inclination of the river, and the nature of the channel, there is probably no better way of improving the navigation between Stourport and Worcester than by means of locks and dams. In saying this, I claim allowance for the limited extent of my information; and certainly, to dispense with the dams altogether, or even partially, would, if practicable, be desirable. Mr. Clegram's idea is that a canal from Worcester to Stourport is practicable, and would be preferable to dams.

Objection to Solid Weirs.—Thus far, and it is a great part of the way, I agree with Mr. Cubitt; but I cannot at all see how, if the dams or weirs are to be solid, as described, without flood-gates or even waste-boards, neither of which are named, they are not to prejudice the drainage, in place of improving it. If made very oblique across the stream, as proposed, their length will no doubt be increased; and with the same depth over the dams, the quantity passed over will be proportioned to the length. But the principal effect of lengthening the weirs will be to decrease the height of the water running over them, and not so much to increase the cubic quantity; for the quantity that reaches the weirs, or the depth at the weirs, is dependent on the direct cross-section (the width and depth) and the velocity above the weirs (that is, higher up the river), than where they are placed; and there

* I extract this from a note made at the time, but I am informed that Mr. Rhodes's plan (previously deposited) shows the weir in the lower situation.

is, I think, no doubt that placing solid dams at intervals across the stream, whether directly or obliquely, and from five to eleven feet above the present bottom of the river will diminish the velocity of that portion of the water which is below the level of the weirs, and near them, and of the whole descending column for a very considerable way up the river; and that in this length so interfered with, particularly near the weirs, first the water will be kept back, then a deposit will take place, which will diminish the depth, and therefore raise the surface of the water and increase the floods. The bed of the river will, in fact, be raised, unless kept down by constant dredging. But, even with dredging, the height of the surface of the water will be raised, independently of the bottom. When Mr. Cubitt says, "there will be a greater water-way on any cross-section at the weir after its erection than before," he either refers to length only, or to some particular depth over the weir at the time of some very extraordinary flood, because the sectional water-way can only be measured from the top of the weir, all under that part being, by the erection of the weir, taken from the area of the water-way. Without, I am sure the most remote intention, the position here stated is apt to mislead; and, independently of the above, I do not calculate on much good from the obliquity of the dams, unless the river be enlarged for a great length above them, so that the stream of the water may come at right angles nearly to the dam. Besides this, there can be no doubt that these permanent weirs will increase the difficulty, to say the least of any great future improvement to the drainage of the country above them. I do not mean to say that the dredging and deepening of other parts of the river will not diminish the effect of the obstruction, but the dams are so much higher than the shoals to be dredged, that I do not think they will by any means counteract the injurious effect, while the dredging without the solid dams would do as much good to drainage as to navigation.

Shropshire Navigation.—To the Shropshire navigation, also, from Ironbridge, the solid dams would be a great obstruction. The statement is, that these boats remain aground at Ironbridge during droughts, and until there is a fresh in the river, when they come down in fleets of twenty to thirty in number, making the passage of seventy miles to Gloucester in from eleven to sixteen hours; that there they unload their cargoes with the greatest dispatch, that they may get up again before the water has gone down. I cannot see how, to this description of trade very serious delay by solid weirs is to be prevented, when each boat is to be locked down and up through five locks, independently of the risk of being carried over the weir when the velocity is considerable.

Can, then, the present delay during droughts be remedied, and yet these evils prevented? I think they can, even presuming dams to be necessary, by forming them not as solid weirs, but as opening gates, to be shut in times of drought only, but to remain open to the bottom of the river in times of flood, and whensoever there is abundance of water for navigation, so that both the flood waters and the trade may pass through the gates without interruption or delay by lockage. These gates need not be the whole width of the river, but the sides only, the space between the banks and the gates, should be furnished with sluice or draw-doors, to open so as to pass the floods, and to this there could not, as it appears to me, be any reasonable objection, unless the expense be such as to exceed the benefit, which when the importance of the navigation is considered, would not, I apprehend, be the case; but if it should be so, I still think that much good might be done by dredging the shoals, and contracting the width, where the too great width is the cause of the formation of the shoals, which, unless where the material is hard, will probably be found to be the case. In most cases, as appears upon the sections, the material of the shoals is too hard to be acted upon by the floods, and then the shoals, once dredged away, will not be likely to form again. Should not the experiment be made? It would be useful, even if dams were constructed afterwards. Undoubtedly the floods of the Severn, if more confined within their channel, would keep a large water-way open.

Worcester to Gloucester.—What I have yet said as to dams is confined to the part of the river above Worcester. Below that city the river assumes a different character, the depth is greater, and the quantity of low land which is liable to be flooded more extended. The entrance of the Birmingham and Worcester Canal is below Worcester; and I have been informed that two-thirds of the tonnage that goes above Gloucester does not go higher than Worcester. Hence, therefore, both as respects drainage and trade, an open unobstructed river between Gloucester and Worcester becomes much more important than above Worcester; the expense of a dam also, such as I have described, much greater, and I hope, and indeed think, it may be dispensed with. Mr. Rhodes designed his ship lock and weir at Saxon's Lode, 17¾ miles above Gloucester, or one mile below Upton Ham, where Mr. Cubitt now proposes it; but, in consideration of interfering with the drainage of the district, he was induced, in his subsequent plan, as I understood him to say, to remove it up to Cleve's Lode, 23¾ miles above Gloucester, or 5 miles above Mr. Cubitt's present site. Now, Worcester is only 6 miles above Cleve's Lode, or 11 miles above Upton Ham. In this length there is more than six feet in depth, excepting at the shoals, which do not appear more numerous than lower down the river, where the depth is proposed to be obtained by dredging. The average fall in the river, from Upton Ham to Worcester, being only 4¼ inches per mile, I think there is little reason to apprehend a want of depth at the upper end, after such a deepening and regulating as will be required. If the excavated material were applied to raise the banks, the land would be less liable to be flooded, and the scour being confined in the channel of the river, would increase the depth. It will be understood that my objection as respects floods is confined to the space above the first weir—all below the weir will be improved by Mr. Cubitt's plan.

Thus, also, the objection made, reasonably as I think, to the inadequacy of one lock to pass the trade, would be obviated, as so large a proportion would stop at Worcester, short of the first lock.

Clyde.—The Severn here is in some respects different from the Clyde, but there is a similarity, and the good effects of not adopting Smeaton's plan of damming the river so as to secure a promised depth of 4 ft. 6 in. at Glasgow, at high-water neap tides, even after an act had been obtained for it, but of deepening and regulating, by which there is now 13 feet, has made that city what it now is, and has much increased the value of the low lands, which were more liable to be flooded than they now are. One would expect the Worcester, of all parties concerned, to be least the advocates for dams and locks between Gloucester, and their city, to limit the capability of their trade in the size and number of vessels; until, at least, it be proved that they cannot be dispensed with; and, whenever this is the case, the importance of having the gates constructed as I have described, to be shut in short-water times only, is greater here, on account of the extent of flooded land, than above Worcester. Whether referring to the extent of the trade, to the delay which will be consequent upon passing every thing through a lock, or to the drainage of the country, I think solid weirs objectionable; and if this be the case now, it will be much more so after the river is improved, if an increase of trade, with the introduction of steam-tugs, be the consequence, as is probable. A tug would take a whole fleet of boats or barges behind her. The Severn is at present far behind in the power applied to track the boats, being partly horse and partly human labour; and I decidedly think the solid weir will tend to perpetuate the slow system. Until steam be general, the towing paths ought to be raised and improved. They appear to lie in the hands of two joint stock companies, and the bill does not attempt to interfere with them, excepting at the proposed new cuts; but perhaps a great reform has taken place in their condition since 1836. The towing paths on the Clyde are entirely abandoned, every thing being done by steam-boats or steam-tugs.

* * * *

Works above Worcester.—The dams above Worcester, as I propose them, would be more expensive than Mr. Cubitt's. I think it probable, supposing dams to be indispensable, that a smaller number might suffice, for the following reasons:—The average present summer inclination in the surface of the river above Worcester is 21½ inches per mile. Mr. Cubitt appears to suppose that, after the construction of the weirs this will be reduced to little more than one inch per mile, which I think very much under the mark, and therefore that the pen of the weirs will reach very much higher than he supposes, thus allowing sufficient depth for a greater length between the locks, which will be desirable. And here I may say, that I do not agree with Mr. Cubitt, when he states that, "if all below the entrance of the Gloucester and Berkeley Canal be left untouched, it is evident that no alteration will be made in the height of the water up to the first weir." On the contrary, every obstruction or shoal that is dredged in the whole length, tends to lower the water in the part of the river above it. The section of the stream being increased by the removal of the shoal, a less velocity, and therefore less slope in the surface of the water, is required for passing the descending water, and hence a sinking of the surface increasing upwards. This must be compensated for by greater dredging toward the upper end, to give the required depth. There ought not to be a difference of opinion on this point, and therefore either the expression does not convey Mr. Cubitt's meaning, or I have misunderstood it.

* * *

JAMES WALKER.

23, Great George Street, Westminster,
March, 1841.

THE TOMB OF THE GREAT CAPTAIN.

(From Dr. James Macauley Foreign Secretary of the Botanical Society, Edinburgh.)

Of the many historical monuments which are met with in the ancient city of Granada, one of the most interesting is the tomb of Gonsalvo of Cordova, the Great Captain. This tomb would in any other place have been a celebrated point of classic pilgrimage; but in a city containing the Alhambra and so many glorious remains of the Moslem empire in Europe, other objects of historic interest have been almost wholly overlooked by travellers. My attention was called to it by a note in my copy of Don Quixote, where it is said that "Gonsalvo toward the close of his life founded a monastery in the neighbourhood of Granada, and was buried in its church. His epitaph, which still remains there, is simple and grand; GONSALVUS FERDINANDUS A CORDOBA, DUX MAGNUS HISPANIARUM, GALLORUM ET TURCORUM TERROR." On making inquiry, I found that the tomb was not in the monastery he had founded, which was that of Cartuja, but in the chapel of the convent of San Geronimo. Of this magnificent edifice, the Nuncio Aldobrandini, while conversing in the Alhambra with Philip V., said that "he had seen nothing in Italy more great in architecture." Separating from this what may be due to the flattering courtesy of a foreigner, there is yet in the remark a good eulogium of the work, and a high testimony to the merit of the architect, the famous Diego de Silöe. He it was who also built the cathedral of Granada, which in magnificence and taste exceeds all the cathedrals of Spain, and may be ranked with the finest edifices in Europe. He spent thirty years in the construction of the convent of San Geronimo; a truly noble piece of architecture, whether we regard the grandeur of the design or the beauty of the details, and a work worthy of the high name which Diego de Silöe bears in the history of art in Spain. The place is at present used as a barrack for soldiers. The remains of Gonsalvo are in a vault in front of the altar in the chapel. This part of the building is in a most desolate and dismantled state, every vestige of decoration and ornament having been destroyed, and the very woodwork of the chapel having been torn down for firewood. What a contrast from the former condition of the place, when historians relate that the shrine was famous for its riches and splendour, and the walls were covered with trophies taken from the enemies of Spain, among which were two hundred banners and two royal standards taken by the Great Captain! The

short epitaph formerly referred to, I was unable to find; but upon one of the flat stones on the floor near the altar I observed the following inscription:—

Gonzali Fernandez de Cordobâ,
qui propriâ virtute
Magni Ducis nomen
proprium sibi fecit.
Ossa,
perpetuæ tandem luci restituenda,
huic interea loculo condita sunt,
Gloriâ minime consepultâ.

The epitaph appeared to me to be happily expressed, and reminded me of the brief and fine eulogium of Cervantes, introduced at the place where the innkeeper brings to the curate and barber his library of three books, two of which were condemned to the flames, but the third was worthy of immortal honour, being the history of Gonzalvo Ferdinand, "el qual por sus muchas y grandes hazañas mereció ser llamado de todo el mundo Gran Capitan, renombre famoso y claro, y dél solo merecido." While our party were in the chapel, a number of the soldiers from the convent had followed us from curiosity, and wondered what we found to interest us in its bare and desolate aspect. In passing through Spain, the traveller at every step meets traces of its former glory and splendour, and cannot help contrasting these with the present degraded state of the country and people. The contrast came with new force to me while in the chapel of San Geronimo; recalling the brave veterans of the wars of Naples and Flanders, then the finest soldiers in Europe, and comparing them with the wretched troops of modern Spain, specimens of which were now gaping and jesting over the remains of the Great Captain.

PORTER AND CO'S PATENT ANCHORS.

One of the most interesting experiments, and one which cannot fail to prove of immense advantage to the navy, and the merchant service, took place on Monday in the presence of Captain Phipps Hornby, C.B., superintendent of Her Majesty's Dockyard, Woolwich, and a number of nautical gentlemen. One of Porter and Co.'s patent anchors having been previously placed on the testing frame, an immense power was applied by an hydraulic machine invented by Bramah and Son, and the anchor weighing 5 cwt. 2 qrs. 24 lb., which would have been considered safe according to the adopted test of 8¾ tons, actually sustained additional strains until it reached 20¼ tons before it gave way under the application of that immense power—nearly 2½ times greater than would ever be required under ordinary circumstances. A second anchor, weighing 5 cwt., was afterwards placed on the testing frame, and the power having been applied, it sustained a strain of 21½ tons, given by jerks, before it gave way, although it would have been considered perfectly safe if it had stood 8¼ tons. There was another anchor by the same patentee on the spot, of still larger dimensions, but the experiments with the other two were so satisfactory that it was not found necessary to prove its capabilities. It appears strange, and yet it is evidently the fact, that the more simple the construction of any article is, there is the greater certainty of its success. The principal difference betwixt this anchor of Porter and Co., and those at present in use, is a projection on the outside of the fluke, which enables it to catch hold of the most difficult ground, and ensures its obtaining a firm hold and double power by the upper fluke descending on the shank, and acting as a fulcrum in the most effectual manner. By the kindness of Captain Denham, of the Marine Surveyor's department, we have been enabled to give the following details of the advantages of this anchor.—"It is almost impossible to foul it. It bites quickly into the most stubborn ground. It holds on the shortest stay peak. It cannot well lodge on its stock-end. It presents no upper fluke to injure the vessel herself or others in shoal water. It cannot injure vessels' bows when hanging cock-bill, as merchant vessels find a convenient practice. It is not so likely to break off an arm or part in the shank as anchors with fixed flukes do, because the construction of these arms can be of continuous rod-iron, and the leverage is so much nearer the ring, owing to the pea of the upper ring closing upon the shank. It is a most convenient anchor for stowing on board, on a voyage, as the flukes can be easily separated, and passed into the hold; it can as easily be transported by two boats, when one would be distressed with the whole weight. Several of the officers who witnessed the experiments stated their intention of applying to the Admiralty for anchors on this construction, as they were so satisfied of their advantages."—*Times.*

PROCEEDINGS OF SCIENTIFIC SOCIETIES.

INSTITUTION OF CIVIL ENGINEERS.

Jan. 12.—Joshua Field, V.P., in the Chair.

"*Remarks on the comparative advantages of long and short Connecting Rods, and long and short stroke Engines.*" By John Seaward, M. Inst. C. E.

The author commences the communication with a description of the engines first placed on board the Steam Frigate, "The Gorgon."

The engines are constructed on the principle of "direct action," that is, the power is communicated directly from the piston to the crank, without the intervention of side levers, and the other parts usually employed in the construction of marine engines; this is one leading feature. Another is, that the main shafts are placed directly over the centre of the cylinder; and as these shafts are carried by strong frames and wrought iron columns standing upon the cylinders, the force of the engines is confined between the cylinders and the frame, and thus isolated from the sides of the vessel. Other advantages accruing from this construction are, in the author's opinion, a saving of space and weight, the absence of the vibration resulting from the action of the side levers, and a more efficient application of motive power, arising from the simplicity of the construction and diminution of friction.

Two main objections have been urged against this system—1st, that the shortness of the connecting rod causes a loss of effect; and 2nd, that the shortness of the stroke is a disadvantageous application of the power of steam.

The arguments in support of these objections are combated at considerable length. With reference to the alleged loss of power by the use of the short connecting rod, it is argued, that as no arrangement of long or short rods or levers could create power; so no arrangement of similar parts could be productive of loss of power. A geometrical investigation of the force actually exerted on the crank by long and short connecting rods is then given, and the result deduced is, that by adding together the whole of the force exerted by the two kinds of connecting rods respectively, during one entire rotation, they both give the same actual amount; thus proving, that no loss arises from the use of the short connecting rod.

It is admitted, that there is some increase of friction on the journals of the connecting rod joints, but this occurs only at the extreme angles; some allowance is also to be made for the increased angular motion about the lower joints of the rod, but they are not collectively of sufficient importance to be considered as any objection in practice.

The calculations given are under the approval of Professor Airy, who thus expresses himself:—"The *greatest* force of the 'Gorgon' engines (when both cranks are below the horizontal line) is *greater* than the *greatest* force with common engines, but the *least* force is not less than the *least* force with common engines."

The whole power, in a complete revolution of the crank, is the same in both.

That a long stroke engine, under certain circumstances, may be more advantageously employed than a short one, is admitted; but considering the steam engine *per se*, it is argued, that the latter possesses no advantage over the former.

In two engines of equal power, equally well constructed, the length of the stroke being respectively eight feet and four feet, the cylinder of the latter having double the area of that of the former, making the same number of revolutions per minute, and having the steam passages and valves of the same area, it is clear, that the mechanical action of the steam must be identical, because the same volume of steam will produce an equal mechanical effect, whether it be introduced into a long narrow cylinder, or into a short wide one; setting aside the effect of working expansively, which, however, is not at all affected by the shortening of the cylinder: for it is just as practicable to shut off the steam at one-half, one-third, or one-fourth of the stroke of a short cylinder as of a long one.

The most essential differences between these two engines must be in the relative amount of friction, and of radiation of heat from the cylinders and passages.

In a well made engine four-fifths of the friction is due to the packings of the piston, air-pump bucket, and stuffing boxes, and about one-fifth to the gudgeons, crank pin, and other moving parts. The friction of the piston packing is as the circumference multiplied into the space through which the piston travels, and into the depth of the packing; therefore in a cylinder 30 inches diameter, 8 feet long, the friction of the packing will be as 24, while in a cylinder of 42·4 inches in diameter, 4 feet long, it will be only as 17.

The same train of reasoning is extended to the other moving parts, and shows that if the total friction in the short stroke be 100, that of the long stroke engine will be 123.

The radiation of heat from the cylinders will be as the relative areas of surface, which is less in the short stroke than in the long.

An examination of the comparative friction of the moving parts of steam engines is entered into; rules for computing, and tabular results are given; and the author concludes by observing, that although the relative dimensions selected as examples are uncommon in England, they are not so in America, where pistons of marine engines frequently travel at the rate of three hundred to four hundred feet per minute. It is contended that the speed of the piston is immaterial, provided the engine be well proportioned to the speed; at the same time bearing in mind that a slow speed will be more favourable for the easy and pleasant working of the engine, and for durability. The paramount objects to be aimed at in the construction of marine engines are, the greatest saving of fuel, space, and weight, and the durability of the machine; and as the question is not whether the stroke should be eight feet or four feet, but relates to a diminution from the present length of seven feet to probably six feet, it is contended that the form of the "Gorgon" engines offers considerable advantages in the points treated of, independently of the positive diminution of weight and space, which forms no part of the immediate inquiry.

A drawing of the "Gorgon" engines accompanied the communication.

"Description of a Thirty-Ton Crane, erected on the Quay of Earl Grey's Dock, Dundee Harbour." By James Leslie, M. Inst. C.E.

The Crane is placed on a stone platform sixteen feet square, raised six feet above the level of the Quay, with its centre seven feet back from the Dock face; and as the sweep or radius is thirty-five feet to the perpendicular of the jib-sheave, the load is suspended twenty-eight or twenty-nine feet over the Dock (as the double or single purchase sheave is used). The height of the sheave above the level of the Quay is forty feet.

Instead of the framing revolving about a fixed post, as in the usual mode of construction, the post itself is connected with the framing, and turns with it, so that the strain may be always in the direction of the greatest strength.

To avoid the extra dimensions of the castings for the post, if it had been composed entirely of cast iron, and for facility in the construction, the parts of cast and wrought iron are so combined that the "push" is thrown upon the cast-iron abutting piece which is placed in front, while the back part, consisting of wrought-iron tension bars, bears the "pull." The two rings on the post are turned on the face and edges, and being bolted together form a fair surface for the friction rollers, while the back forms a rest for the tension bars.

These back tension bars are three inches wide by two and a half inches thick, each, forming an aggregate section of forty-five inches. They were all proved in the bent form in which they are used, by making fast the ends of each bar to cross heads held apart by two logs, and suspending a load of twenty-four tons from the elbow formed by the bend in the bar; this was calculated to be equivalent to a longitudinal strain of ninety tons. There are also two side tension bars, two inches square each, firmly sunk in the cast-iron block, and bolted to the top of the framing.

The post revolves within a cast-iron cylinder twenty-seven feet deep, five feet three inches diameter, with turned and bored water-tight joints. The whole is surrounded with masonry, bound together by strong iron hoops and diagonal tie bars passing through the fixed ring.

The jib is of oak two feet diameter in the middle, and twenty-one inches at the ends; the two wrought-iron jib stays are each three and a half inches diameter; the chain is of 1¼ inch iron. Eight men easily lift a weight of thirty tons, and by means of the horizontal wheel-work one man can turn it round.

The total weight of the castings, wrought-iron bars, chain, and brasses, is about fifty-nine tons.

The crane was made and erected by Mr. Borrie, of Dundee, from the designs and under the direction of the author.

The communication is accompanied by two elaborate working drawings, on a large scale, with details of the mode of construction.

"A Refrigerator, or Machine for cooling Brewer's Wort." By Robert Davison, M. Inst. C.E.

The machine described in this paper was constructed for the purpose of ascertaining the most expeditious process for cooling wort, without deteriorating the quality of the liquor.

Two kinds of preliminary experiments were made, viz.—

1st. As to the rate of cooling by simple exposure to the atmosphere in the ordinary shallow vessel, having a superficial area of 420 square inches, the liquor being 1¼ inch deep.

2nd. As to the rate of cooling, under similar circumstances, with the assistance of air mechanically driven over the surface of the liquor at different velocities.

In both cases the loss by evaporation was noted.

The numerous experiments are detailed in a tabular form, whence may be selected three series, which will give the average relative results.

Wort cooled.	Naturally under Atmospheric Temperature, 75°.		1. By Blast at the rate of 32 miles per hour. Temp. 65°		2. Blast at the rate of 47 miles per hour. Temp. 65°		3. Blast at the rate of 57 miles per hour. Temp. 65°		4. Blast at the rate of 84¼ miles per hour. Temp. 65°	
	min.	sec.	min.	sec.	min.	sec.	min.	sec	min.	sec.
From 160° to 150°	3	33	2	..	1	30	..	41	..	25
From 130° to 120°	8	30	1	10	2	4	1	6	1	7
From 100° to 90°	22	5	6	30	3	41	3	16	2	3

A higher velocity than 84¼ miles per hour was found prejudicial, as a portion of the wort was driven over the side of the vessel.

The relative loss by evaporation was

By natural cooling............................ 1·40
By blast, at 32 miles per hour .... 1·45
Ditto at 57 miles........................... 1·47

Hence it would appear, that the evaporation effected was about the same in all the experiments; and the rate of refrigeration nearly in the direct ratio of the velocity of blast.

These results induced the author to try other applications of the blast, by causing the wort to flow down over a series of slightly inclined planes, being exposed at the same time to a powerful ascending current of air from a fan blower. The introduction of air directly into the wort was, however, found to raise a froth or "fob," which would affect the soundness of the beer. Several other methods were tried, and at length the machine now described was constructed.

The wort is pumped up at a slow and regulated speed into a recipient at the top of the machine, divides into a series of thin films or streams, and trickles down the inside of a number of thin metallic tubes, set vertically, with their upper extremities quite level. Up these tubes is forced a current of air at any required velocity, which, meeting the descending wort, cools it inside, whilst a constant change of cold water takes place around the exterior of the tubes. The wort, on leaving the vertical tubes, is received into a second refrigerator, containing a number of horizontal pipes through which cold water flows. By this process the wort is cooled without producing any prejudicial effect upon its quality, and with a rapidity (as shown by the table) which would be extremely advantageous under certain circumstances.

This communication was accompanied by two drawings of the Refrigerator, and illustrated by a working model with which the experiments had been made.

"An Account of the Repairs and Alterations made in the Structure of the Menai Bridge, in consequence of the damage it received during the gale of January 7, 1839." By T. J. Maude, Grad. Inst. C.E.

The roadway of the Menai Bridge having been seriously injured by the storm of January 7, 1839, it was deemed expedient to renew entirely the suspended platform: and at the same time to carry into effect certain alterations in the construction, suggested by constant observation of the working of the Bridge during thirteen years, as well as its condition after the storm.

In the original structure, each long roadway bar was fixed at three points to the vertical suspending rods. Motion being chiefly communicated to the roadway by the vibration of the windward chain, one end of the long bar suspended from it was lifted up, whilst the other two points of suspension remained nearly stationary. The bar thus became a lever with its fulcrum at the middle point of attachment, and at that weakest part it invariably broke. In order to remedy this defect, an augmented depth of half an inch has been given to the new roadway bars, with an additional enlargement round the eyes for attachment to the suspension rods, and each bar is hung from two points only, permitting it to play when the Bridge is subjected to motion.

The same vibratory action occasioned frequent fracture of the suspending rods close to the surface of the platform; to such an extent, that during the storm a great portion of the platform was entirely torn from its fastenings on one side, and hung down flapping in the gale supported merely by one line of rods. To remedy this, a joint has been introduced in each rod just above the surface of the platform, so as to allow the suspension rods free action, and permit a motion in either of the carriage-ways or the footpath independently of each other. The dimensions of the short suspension rods have been increased to one inch and a quarter square, whilst the remainder of the rods are only one inch square. The effects of the lateral and undulating motions are provided against by the direction of the working of the joints, one of them being in the line of the roadway bar, and the other at right angles to it.

Additional rigidity has been given to the platform by applying a course of three-inch planking laid transversely throughout its entire length, and bolted through each plank at intervals of two feet six inches apart, the oak beams originally placed beneath the platform having been entirely removed.

For the purpose of checking longitudinal undulation, two lines of beams, formed of two pieces of Baltic fir, each 40 feet long, 13 inches deep, and 4½ inches thick, are framed to the trussed bearers, and bolted up beneath each carriage-way the entire length of the platform: at the same time an increased depth has been given to the wheel guides, which are also bolted through to to the planking. The total depth given by these strengthening beams and guides, is three feet four inches, while in the original structure it was one foot four inches.

The weight of the additional timber and iron-work introduced into the bridge, is about 130 tons. The whole of the timber has been Kyanized, and each coat of planking covered with Archangel tar; the felt has been discarded, as it does not appear to have answered its intended objects in the original structure.

In these alterations (which were designed by Mr. Provis, M. Inst. C.E.) one main object, which was never lost sight of, was to preserve that simplicity of construction which is so striking a feature in the original design; and should any future derangements occur, any part can be repaired or replaced without disturbing the rest of the structure.

This communication was illustrated by a drawing of the original platform, and of the alterations described in the Paper.

February 2.—The PRESIDENT in the Chair.

"On a Method of setting out involute Teeth of Wheels, so that any two wheels of the same or of different diameters will work truly together, whether the teeth bottom or only just touch each other." By Edward Cowper.

The rule is briefly this:—

Point off the teeth on the pitch circle in the usual manner; then take the smallest wheel of the set, and having decided upon the depth of the proposed tooth, describe a circle (called the Evolute) touching the bottom of the tooth.

On all the other wheels describe evolute circles, bearing the same proportion to *their* respective pitch circles, which the evolute circle of the smallest wheel bears to *its* pitch circle—thus, if in the smallest wheel the evolute circle is $\frac{1}{10}$th less than the pitch circle, let all the other evolutes be $\frac{1}{10}$th less than *their* pitch circles. From these evolute circles as bases, describe the involute curves of the teeth, making the curves pass through the points set out for the teeth, upon the pitch line.

"*An Account of some Experiments to determine the force necessary to punch holes through plates of wrought iron and copper.*" By Joseph Colthurst.

These experiments were performed with a cast-iron lever, 11 feet long, multiplying the strain ten times, with a screw adjustment at the head, and a counterpoise.

The sheets of iron and copper which were experimented upon were placed between two perforated steel plates, and the punch, the nipple of which was perfectly flat on the face, being inserted into a hole in the upper plate, was driven through by the pressure of the lever.

The average results of the several experiments (which are given in a detailed tabular form) show that

The power required	Inch diam.	Through an	Inch thick.	
to force a punch	0·50	iron plate	0·08	is 6025 lb.
Ditto	0·50	Ditto	0·17	is 11,950 lb.
Ditto	0·50	Ditto	0·24	is 17,100 lb.
Ditto	0·50	Through a copper plate	0·08	is 3983 lb.
Ditto	0·50	Ditto	0·17	is 7863 lb.

Hence it is evident, that the force necessary to punch holes of different diameters through metal of various thicknesses, is directly as the diameter of the holes and the thickness of the metal.

A simple rule for determining the force required for punching, may be thus deduced.

Taking one inch diameter, and one inch in thickness, as the units of calculation, it is shown that 150,000 is the constant number for wrought-iron plates, and 96,000 for copper plates.

Multiply the constant number by the given diameter in inches, and by the thickness in inches; the product is the pressure in pounds, which will be required to punch a hole of a given diameter, through a plate of a given thickness.

It was observed, that duration of pressure lessened considerably the ultimate force necessary to punch through metal, and that the use of oil on the punch reduced the pressure about eight per cent.

A drawing of the experimental lever and apparatus accompanied the communication.

"*Geological Sections of Railway Cuttings.*" By Mr. Sopwith.

Mr. Sopwith called the attention of the meeting to the valuable Geological Sections presented by the railway cuttings, and other engineering works now in progress; this was particularly the case on the North Midland Railway, where the crops of the various seams of coal, with the interposing strata, were displayed in the clearest manner, developing the geological structure of the country which the railway traverses. Numerous similar instances induced the British Association to devote a sum of 200*l.* (which it was believed would be increased from other sources), for obtaining authentic records of such sections, before the action of the atmosphere or the progress of vegetation should have obliterated the instructive pages of geology, which the engineer had opened to view.

The Committee of the British Association, especially charged with this subject, were desirous of bringing it before the Institution of Civil Engineers, for the double purpose of receiving from its Members those suggestions which they are so competent to give, and of obtaining from them that powerful aid and co-operation which the practical nature of their engagements so essentially enabled them to afford; it was accordingly suggested, that the Council should receive from Graduates, descriptive papers and measured delineations of sections, as their communications previously to their Election. Much assistance might thus be rendered, and the contributions, after having been read at the Institution, might be added to the general series preserved in the Museum of Economic Geology, which under its present able direction is becoming daily more interesting both to the engineer and the geologist.

Mr. Sopwith exhibited a specimen of a blank chart, prepared by Mr. Phillips, of York, for the committee. It consisted of a sheet engraved in squares, on a scale of 40 feet to an inch, containing a space equivalent to 800 feet in length, and 600 feet in height, upon which it was proposed to delineate the sections in their true vertical and horizontal proportions; the base line representing either the level of the sea at half tide, or the datum line of the railway, as might be most convenient. There would remain in every case a large portion of the sheet unoccupied by the section, and upon this it was proposed to exhibit, on a magnified scale, the details of the section; the fossils and other organic remains might also be shown, as the divisions of the squares would enable the sketches to be made of any dimensions in correct proportions. An example of these charts had been prepared by Mr. Phillips, giving a section of a deep cutting on a railway, the enlarged portion exhibiting the details of the strata at two particularly interesting points, as also of the specimens of sigillaria, stigmaria, &c. in that formation.*

Geological Models.—Mr. Sopwith also laid before the meeting a set of models, which were intended as hand specimens for the purpose of familiarly explaining faults, slips, or dislocations of the strata, and other geological phenomena, which could not be clearly demonstrated without such assistance. One of these models represented the horizontal deposition of stratified rocks, and the subsequent removal or degradation of such rocks, forming valleys of denudation. Another, by the displacement of the lower rocks, exhibited the formation of a slip dyke, or fault, which was the "lode or vein" of the mineral miner, and the "fault" or "trouble" of the collier, as these interruptions of the continuity of the bed of coal were generally termed. Another model showed a succession of slip dykes disturbing the stratification, so as to present the appearance of a great abundance of coal at the surface by the "cropping out" or "bassetting" of a number of seams or beds of coal, whereas in reality there was only a repetition of the same beds. By examining the base of the model, and also by opening it on an oblique plane nearly parallel with, and at a short distance below, the surface, it would be found that there was no coal at all. A fourth model exhibited the conditions under which some of the largest collieries in the kingdom are worked, namely, that the seams of coal do not appear on the surface, but on opening the model a vertical section is exhibited, and the several beds are shown, disturbed as in the former case by faults or dislocations, but which have not the effect of bringing the coal to the surface.

It has always been difficult to demonstrate without the aid of models the apparent form of strata, as effected by the contour of the country; sometimes the rocks form a V, pointing up the valley, and sometimes in the opposite direction. General observers and even practical miners were apt to conclude, that this different direction of the point of the V, indicated a different direction of the strata, but the models showed that in both cases the direction of the strata was the same; that in both cases the rocks were inclined in the same direction as the valley, the only difference being that in one case the rocks form a greater, and in the other a less, angle with the horizon than the bottom of the valley. The other models exhibited the "up-cast" and "down-cast" which occur in coal mining, and intersections of veins of different ages, &c. Most of the specimens shown presented details of the carboniferous formation, but models of this description were of course applicable to every formation and to every kind of geological structure. Mr. Sopwith brought forward this subject in hopes that eventually a close union and active co-operation might be established between the leading scientific institutions of this country, and more especially that the Geological Society and the Institution of Civil Engineers would unite in promoting the progress and improvement of geology and engineering.

February 9.—The PRESIDENT in the Chair.

The following were balloted for and elected: Sir Charles Baird, as a Member; Samuel Beazley, William Gossage, John Hughes, John Howkins, and Charles Schafaeutl, M.D., as Associates.

"*Upon the Application and Use of Auxiliary Steam Power, for the purpose of shortening the time occupied by Sailing Ships upon distant voyages.*" By Samuel Seaward, M. Inst. C.E.

But few years have elapsed since the possibility of propelling vessels by the power of steam was treated as a chimera; and although the practicability of its application for short voyages has been successfully demonstrated by the numerous vessels plying between this country and the Continent, it is but of very recent date that its employment for long sea voyages has been adopted. The weight of the powerful machinery and the fuel, and the consequent loss of space for cargo, together with many other circumstances attendant on the present construction of steam vessels, induced the author (who received the education of a seaman, and has since had extensive practice as an engineer) to believe that a more efficient mode of employing steam power for long sea voyages might be adopted.

Notwithstanding the great improvements which have taken place in the construction of steam vessels, and their machinery, it would appear that the duration of the voyage ought not to exceed twenty days, after which time a fresh supply of fuel becomes necessary; hence, steam has rarely been adopted for very long voyages. The reason of this limit to the duration of the voyage of a steam vessel, as at present equipped, is that an increase of power does not produce a corresponding increase of speed, while the weight of the machinery increases in proportion to the power employed, and in some cases exceeds it; for instance, small engines, with the water in the boilers, generally weigh about one ton per horse power, while in some large engines the ratio is nearly twenty-five cwt. per horse power.

A quadruple increase of power will not produce double the original velocity in a steam ship, although, in theory, such is assumed to be the case; for as the weight is more than doubled, the immersed sectional area becomes greater, and a still further increase of power is necessary. It has been shown by experience, that if a vessel with a given power is propelled through the water

* Specimens of the prepared sections and blank charts may be obtained from Mr. Delabeche or Mr. Jordan, at the Museum of Economic Geology, Craig's Court, Charing Cross, or from the Secretary of the Institution of Civil Engineers.

at the rate of eight miles per hour, her speed cannot be doubled, even though the power be multiplied twelve times, and the entire hold of the vessel occupied as an engine room.

The weight of fuel is also in direct proportion to the size of the engines; so that taking, for example, two vessels of two hundred and of four hundred horses power respectively—that of the higher power will have to carry nearly double the weight both of fuel and of engines, and it is still questionable whether the increased force will propel the one ship more than 1½ mile per hour faster than the other.

The space occupied by the engines and fuel in the most valuable part of the ship, is also an important consideration: neither the "President" nor "British Queen" steamer, although of two thousand tons measurement, is capable of carrying more than five hundred tons of cargo when the fuel is on board.

The author then examines the question of employing too much power in a steam vessel, and refers to the "Liverpool," as an instance that such may be the fact. It appears that with the original dimensions of thirty feet ten inches beam, and engine power of four hundred and fifty horses, being a proportion of power to tonnage of about 1 to 2¼, the vessel was immersed four feet beyond the calculated water line, and a decided failure was the natural consequence; but when the breadth of beam was increased to thirty-seven feet, augmenting the capacity four hundred tons, and giving the proportion of one horse power to 3⅔ tons burthen, the performance of the engine and the speed of the vessel were both materially improved.

The "Gem," Gravesend steamer, one hundred and forty-five feet long, by nineteen feet beam, had two engines of fifty horses power each; the speed was insufficient, being only twelve and a half miles through the water; but when the same engines were placed in the "Ruby," which was one hundred and fifty feet long, and nineteen feet nine inches beam, the velocity of the latter vessel was thirteen and a half miles per hour. A pair of engines, of forty-five horses power each, were then placed in the "Gem," without altering the vessel, and in consequence of the diminished weight and draught of water, her speed then nearly equalled that of the "Ruby."

The author does not condemn the application of considerable power for vessels, provided it can be employed without materially increasing the weight and the area of the immersed midship section. It appears that the length of a steam voyage, to be profitable, is at present limited to twenty days for the largest class of steamers; that we have about thirty others which can approach twelve days, while the majority cannot employ steam beyond eight days successively, without a fresh supply of fuel. It is evident, therefore, that more efficient means must be adopted for the general wants of commerce in our extended intercourse with the East and West Indies, the Pacific, Mexico, Brazil, Australia, and all the distant colonies, which now demand rapid communication with England.

The author refers to a pamphlet, published by him in 1827, entitled, "Observations on the possibility of successfully employing Steam Power in navigating Ships between this country and the East Indies by the Cape of Good Hope." He therein proposed that large square-rigged ships, of fifteen hundred to eighteen hundred tons measurement, should be fully equipped and constructed, so as to sail ten or eleven miles per hour with a fair wind; that they should carry engines of small power, to assist the sails in light winds, propel them at a moderate speed during calms, work into and out of harbour, &c., and thus shorten those portions of the voyage wherein so much time was usually lost.

To all well-built good-sailing vessels, of four hundred tons and upwards, "auxiliary steam" is applicable. A steam engine of the necessary power can without inconvenience be placed in such vessels, either on or between decks, so as propel a ship at the rate of four to five nautical miles per hour in a calm, and for this speed a proportion of one horse power to twenty-five tons is amply sufficient. The practicability of applying this system to East Indiamen and other similar vessels is then examined at length, and it is shown that the ordinary speed of these ships under sail is, before the wind, eleven to twelve miles per hour, and in a gale thirteen to fourteen miles per hour, which is greater by two or three miles per hour than that of any ordinary steam vessel when under sail, on account of the latter being impeded by the wheels trailing in the water, and the slightness of their masts, spars, and rigging. The auxiliary steam power might, therefore, be efficiently applied, either by using it alone, or in conjunction with the sails, so as to keep up a uniform speed, by which a great saving of time could be effected in a long voyage.

The conditions of sailing and steaming voyages to India, with the influence of the trade-winds, are then examined, and the author proceeds to detail the experiments made by him, on board the "Vernon" Indiaman, which was the first sailing vessel that actually made a voyage out and home with "auxiliary steam."

The "Vernon," built in 1839, by the owner, Mr. Green, was one thousand tons burthen; the sailing speed was about twelve to thirteen miles per hour in a fresh gale, and being from her frigate build well calculated for the experiment, it was determined to equip her with a condensing engine of thirty horses power, placed midships on the main deck, between the fore and main hatchways; the space occupied being twenty-four feet long by ten wide. The weight of the machinery was twenty-five tons, and it was so arranged that the motion was communicated direct from the piston cross-head by two side rods to the crank on the paddle shaft, placed immediately behind the lower end of the steam cylinder, which was horizontal. The wheels were fourteen feet diameter, projecting five feet, and were so constructed that the float boards could be raised to suit the draught of water of the ship; or they could be taken entirely away, if necessary, leaving the shafts projecting only eighteen inches beyond the sides. Under ordinary circumstances they were disconnected from the engine by a simple contrivance, consisting of a moveable head, attached to the crank on the paddle shaft, by turning which, one quarter of a circle, the crank pin was liberated, and the wheels turned freely round. The "Vernon," thus equipped, having on board nine hundred tons of cargo, and sixty tons of coal, drew seventeen feet of water. In the first trial the speed of the vessel, under steam alone, was five and three-quarters nautical miles per hour, demonstrating how small a power is necessary for a moderate speed. She then started for Calcutta, and though the piston rod broke three times during the voyage, owing to a defect in one of the paddle shaft bearings, the passage was satisfactory. The details are given minutely, as are also those of those homeward voyage, which was performed from Calcutta to London in eighty-eight days, to which must be added seven days for necessary delay at the Cape, making a total of ninety-five days, which is the shortest passage on record. Great credit is given to Captain Denny for the judgment with which he used the auxiliary steam power, and the course taken by him, by which he was enabled to overcome the difficulties incidental to a first trial of so important a system. The success of the "Vernon," induced the immediate application of engine power to the "Earl Hardwicke" Indiaman, and both these vessels are now on their voyage out to Calcutta.

This communication was accompanied by drawings of the "Vernon" and the "Earl Hardwicke," and by a chart, on which was laid down the proposed daily course of a steam ship, on a voyage to and from Calcutta, showing where sails only are necessary, then where steam alone, and also when the joint agency of steam and wind would be required. Also, the daily progress of the "Marquis of Huntly" Indiaman, of fourteen hundred tons burthen, on a voyage to India and China, and home, from the author's own observation, in the year 1816.

For the purpose of demonstrating the ratio of power to velocity, a Table was also given showing the velocities of ships of different tonnage, having steam power of various ratios, deduced from upwards of one hundred experiments on large steam vessels. The mode of disengaging the cranks was illustrated by models showing the gradation, from the complication of the first idea, to the beautiful simplicity of the present plan, which is now employed on board of the Government war steamers.

ROYAL INSTITUTE OF BRITISH ARCHITECTS.

April 19.

The Institute met for the first time after the Easter recess. Jos. Kay Esq., V. P., in the Chair.

Beriah Botfield, Esq., M. P., was unanimously elected an Honorary Fellow.

The Secretary announced the subjects for the prizes for the ensuing Session, viz. a restoration of Crosby Place, Bishopsgate Street, with the addition to the medal of ten guineas liberally offered by Miss Hacket, to whom the public are so greatly indebted for the preservation of what remains of that fine specimen of the Palatial architecture of the 15th century; an essay on the properties of light, shade and reflection in architecture, and another on the effects which may result to architectural design, from the general use of cast iron in construction.

A paper was read by Mr. Poynter, Fellow, on the state of Windsor Castle, previously to the erection of the existing *domus regis* by Edward III, in the 14th century. It is unnecessary to enter into any analysis of this paper, as the materials were drawn from a prefatory essay to Sir Jeffry Wyatville's illustrations of Windsor Castle, which will immediately be in the hands of the public; but that portion of it which was laid before the Institute, was made illustrative of a ground plan, in which the condition of the Castle, as it was left after the extensive alterations of Henry III. was laid down upon the authority of original documents, the greater part of which have now been brought to light for the first time.

A communication was read from John White, Esq., in pursuance of the subject brought before the Institute at a former meeting, the remains of ecclesiastical architecture in the pointed style, at Wisby, in Gothland. Mr. White's supplementary paper went to support, by the authority of Torfæus, and other historians, his theory on the date of those buildings, by adducing evidence on the advanced state of the arts in Scandinavia, as early as the tenth century.

The meeting adjourned to the refreshment of tea and coffee in the Library.

On Monday evening of the 26th ult., the President Earl de Grey, opened his house for the reception of the Members of the Society. The Council had the honour of dining with his Lordship, and the conversazione which followed was attended by a numerous party of noblemen and gentlemen eminent in art, science and literature. The Marquis of Lansdowne, Lord Prudhoe, Mr. Baron Parke, Mr. Rogers, Sir Edward Cust, Sir Henry Halford, Sir Henry Ellis, Sir Richard Westmacott, Sir Francis Chantrey, Sir Frederick Madden, Sir Gardner Wilkinson, Sir John Rennie, Sir Isambard Brunel, Professor Willis, the President of the Institute of Civil Engineers, Mr. Allan Cunningham, Mr. Copley Fielding, Mr. Ross, Mr. Harding, Mr. Hagbe, and Mr. Joseph Nash were among the guests. A small party of ladies were also present, including the Duchess of Northumberland, the Marchioness of Lansdowne, &c. The tables were covered with works of art, among which Mr. Nash's splendid drawings of old English mansions were conspicuous.

RANDOM NOTES ON STEAM NAVIGATION.

"A VERY cursory survey of the various nations into which in the designs of Providence this earth of ours is portioned, cannot fail to excite our wonder and admiration of His master-workings for this our favoured habitation. While the British Isles appear a mere speck, as it were, upon the surface of the ocean, and are gifted with none of what are usually described as the more precious productions of nature, and while Golconda with her diamonds, and Peru with her gold, have scarce yet emerged from the obscurity of barbarism, we are naturally led to the enquiry as to *how* our little nation has surmounted the difficulties that might have daunted her energies and baffled her progress, and marched triumphantly forward until the clarion of her renown and the majesty of her sceptre have awed the very outskirts of the world. With a soil requiring laborious tillage for its culture, but with that abundantly productive of the necessaries and even the luxuries of life, with mines rich in the baser ores, yet prompting the researches of the chemist, the metallurgist, and the manufacturer, to administer to their profitable appropriation, and with such vast resources in her coal fields as have abundantly sufficed for the efficient development of her other subterraneous resources, her native energies have been kindled through difficulties. Scorning the limits of indigenous productions, the world has been ransacked for the gratification of her insatiable enterprizers. Nation after nation has bowed to her triumphant sway, while at home she has devoted herself to such subtle ingenuities as have, at length, evented in her careering through space with the velocity of the eagle, or trampling over the ocean as the mighty leviathan."*

A review of the progress and extension of the art of steam navigation would be the highest testimonial of its intrinsic and consummate importance Twenty years have scarce elapsed since, amid incredulity and ridicule, Fulton committed his little steam pinnace to the bosom of the Hudson; and long posterior to that event, the idea of traversing the ocean by the agency of steam was regarded as visionary and unattainable. Yet, within a few years, have we witnessed not merely the realization of this idea, but the extension of steam navigation to every part of the habitable globe. Every sea has become the scene of its triumphs—every land the recipient of its attendant beneficence. The frigid barriers of the pole have been constrained to attest its power—the dreary wastes of the Atlantic have been compelled to acknowledge its sovereignty. Art has usurped the dominion of Nature, and subjected even the elements to its sway. It would be difficult to form any adequate estimate of the effects on the moral and physical condition of mankind which may be expected to arise from the operation of this wonder-working agent. Every line of rapid and commodious communication between nation and nation is a channel through which knowledge, civilization and benignity will flow; and these main streams, by their subdivision into numerous minute ramifications, will transmit to the most obscure regions a portion of their invigorating influence, like the generous river of Egypt, which distributes its waters through innumerable channels to revive and fertilize the thirsty soil. Amid the general enlightenment resulting from these influences, national antipathies will be extinguished, and superstition and intolerance will cease to exist, and the irresistible progress of knowledge, the stately march of liberty, the happy approach of that period when the gorgeous East shall cease to shower on her kings *barbaric* pearls and gold, may be referrible to the achievements of modern ingenuity in the completion of this its most stupendous monument.

It would be irrelevant to our present purpose to pursue these considerations. We therefore proceed at once to announce our intention to embody, in a series of articles, the essential part of whatever information respecting steam navigation we ourselves possess, to explain those scientific principles which are essential to an intimate knowledge of the marine steam engine, and to communicate such practical details and precepts as extensive opportunity of investigation and considerable experience have enabled us to collect.

It is a circumstance which has frequently excited surprise and regret, that notwithstanding the important position which steam navigation has now universally assumed, there is yet no practically useful treatise devoted to its consideration. Dr. Lardner's elegant treatise on the steam engine is only adapted to the unprofessional reader, and the able treatise of Mr. Farey does not, in the only volume that has yet been published, embrace the subject of steam navigation. The recent edition of Tredgold contains much valuable information on the subject of steam navigation in the form of an appendix; but having been communicated by different individuals, it wants unity and sometimes consistency. Useful facts and valuable deductions are mixed up with inexact information and irrelevant narrative. To make a judicious selection from such a heterogeneous compilation to appropriate what is important and authentic, and reject what is valueless or inaccurate, pre-supposes the possession of that knowledge which it is the object of the student to obtain.

The production of a useful practical treatise upon the subject of steam machinery requires the agency of an able practical engineer, and there are few skilful engineers who cannot more beneficially occupy their time than in subjecting themselves to the unrequited labours of authorship. Among the makers of steam engines there are some who possess the requisite knowledge for the production of an able and valuable treatise upon the machinery of steam vessels, but independently of the importance of their time, there exists the strongest disinclination to reveal the mysteries of their profession, or to furnish any information relative to the qualities or nature of particular modes of construction. Each maker considers that he possesses some superior contrivance, arrangement or adjustment, the secret of which he desires to retain for his individual benefit, and the nature of which he endeavours to keep unknown even to his own workmen. Some regard the setting of the valves as their forte—others the proportion of their boilers, and others the peculiar mode of finishing or fastening certain parts of the machinery. The acquisition of a competent knowledge of the business of an engineer is in consequence an achievement of the utmost difficulty—information has often to be clandestinely obtained, and of the few who by dint of assiduity and good fortune, succeed in forcing their way into the sacred penetralia, appeared desirous to avenge himself for the labour, by excluding as many as possible of his neighbours.

We cannot but regard the secrecy which has been attempted to be preserved upon these subjects, as a reproach to the present liberal and enlightened age. It is a remnant of the ancient policy which nearly a century ago governed Boulton and Watt's establishment, and which, though at that time circumstances might perhaps have rendered it prudent and advisable, is at the present day inexcuseable and ridiculous. What secrets are they which the makers of steam engines have it in their power to conceal? Their works go abroad to the world, are cast in the course of events into the hands of other engineers, by whom they are dissected and criticised, when every peculiarity they possess is at once recognized and made public. Is it then expedient to reveal the existence of an illiberal spirit where it is impracticable to exercise an illiberal policy? Is it wise to proclaim to the world that we would desire to repress the interchanges of knowledge, and restore the ancient dominion of ignorance and empiricism? Have we the hardihood or the indiscretion to confess that with us impotency is the only limitation to restriction? "The whole tendency of empirical art is to bury itself in technicalities, and to place its pride in particular short cuts and mysteries known only to adepts; to surprise and astonish by results, but to conceal processes. The character of science is the direct contrary. It delights to lay itself open to inquiry, and is not satisfied with its conclusion till it can make the road to them broad and beaten: and in its applications it preserves the same character; its whole aim being to strip away all technical mystery, to illuminate every dark recess, and to gain free access to all processes, with a view to improve them upon rational principles.*" But it would be vain to expect that engineers will become converts to these enlightened views so long as their supposed interests lie in another direction—so long as they imagine the exercise of a craft to be more profitable than the practice of a profession, and that it is practicable to conceal, and yet employ the secrets of which they imagine themselves to be possessed. The constitution of human nature is opposed to such a consummation; and it would be too much to expect that our mechanical engineers should be an exception to the general disinclination to sacrifice accredited private interest to the cause of philanthrophy or of public duty.

The extinction of this spirit would be productive not merely of benefit to the community, but would enhance the reputation and promote the interests of our leading engineers themselves—we shall accomplish an object which we conceive ought to be generally acceptable, if we contribute to the obliteration of this, the only blot with which their fair fame is sullied.

It will be manifest from the title we have chosen, that in the observations we have to offer, we do not bind ourselves to an adherence to systematic arrangement—nevertheless we shall endeavour to thread all our memorandums upon the same string, and that too with some approximation to order. For the sake of continuity it will often be necessary to repeat what may have been said before: indeed we advance no pretensions to originality, although we are sensible it may be

* Thoughts on Steam Locomotion. Weale, 1840.

* Sir J. Herschell.

found that much of the information we may furnish is not to be found in any other publication.

The heads under which our observations will be given, are—

1st. Heat.
2nd. Steam.
3rd. Investigation of the reciprocal proportions of marine engines.
4th. Investigation of the requisite strength of the parts of ditto.
5th. Boilers.
6th. Practical details.

Critical and illustrative annotations by Mr. Farey, Dr. Lardner and others, will be appended, which, for the sake of distiction, will be marked with their respective initials.

BETH.

WESTMINSTER BRIDGE.

In the preceding volumes of our Journal we gave several notices of the repairs and improvements in progress at Westminster Bridge, and have now great pleasure in fulfilling our promise of continuing them.

The second coffer dam has been closed within the last five months, and a more successful result from work of this description we have never witnessed; indeed it appears to be one of the greatest triumphs of hydraulic engineering, to find a dam, (erected in a tidal river with a rise and fall of 18 feet of water, and exposed to every trial that one of the severest winters on record could subject it to,) so completely resist the efforts of its most insidious adversary, that after the wear and tear of five months, there is scarcely sufficient water from leakage to supply the ordinary demand of the works, and this too, on ground that was declared unsuited for the purpose, by the engineer who constructed the bridge, and by all who succeeded him up to the time when the present works were commenced, if we may judge from the way in which they carried on the repairs, and from the schemes for restoring it as exhibited in their reports.

The present dam encloses the 16 feet and 15 feet piers. Of the former we have only to observe, that the foundations were found similar to those in the first dam, the caisson resting on a bed of gravel, underneath which was the blue clay; they have since been secured in the manner already described in a former notice (vol. ii. p. 203), and the masons are proceeding with the new facing, of Bramley-fall stone, above the lowest low water mark, and also with the extension of the pier on the upper side, whereby the roadway may at any future time be widened 12 feet, without again having recourse to the expensive preparation of coffre dams.

The 15 feet pier is the one memorable in the history of the bridge, as having, by its sinking, delayed the opening to the public for three years, and given an apology to the party opposed to Labelye, (the engineer), to assail him with every slander that malice could invent, and by tampering with the commisioners, to nearly prevent the completion of the bridge according to his original design. How severely this treatment affected Labelye, we may see from a work published by him afterwards, in which he repels their attacks with great spirit, and with a bitterness that must have arisen from feeling himself deeply injured. We will here give a few extracts from this work, detailing the extent of damage done to the bridge by the accident, and the means he adopted to remedy it.

"On the 14th November 1746, the bridge and the roads and streets on both sides were completely finished, and the whole was performed in seven years nine months and sixteen days. The commissioners intended soon after to have opened the bridge for the service of the public, but were prevented by an accident entirely unforeseen, and not easily accounted for. In the months of May and June, 1747, the western fifteen foot pier was perceived to settle, very gently at first, but so much faster towards the end of July, that it was thought absolutely necessary to take off the balustrades, &c., by the continuation of the settling, the adjoining arches lost their semicircular figure, and considerable openings in the joints showed them in danger, some of their stones both in their fronts and soffits were split and broken, and one of them actually fell out of the least arch into the river."

The first steps taken were to carry up the two external piers of the two arches that were damaged quite solid, in rubble stone and mortar, to the level of the top of the arches, and to load them sufficiently, in order to preserve the other arches and piers of the bridge; centers were then put up to carry the two arches, and they commenced loading the damaged pier. The account of the last proceeding Labelye thus describes; "the whole weight of load placed on the said pier was so far magnified by writers of daily news and monthly magazines, as to be called 12,000 tons, while it never did exceed 700 tons, which was about a third of what I intended to load it with." What prevented this, was the influence of the party opposed to him, who persuaded the commissioners that further loading would be dangerous, and prevailed on them to give him orders to unload the pier, and take down the damaged arches." "This order," says he, "was the first and only one I ever received from the commissioners contrary to my judgment or opinion, and which I obeyed, *but I own not without some concern.*"

We may here remark that the execution of this order, (as will be seen in the latter part of our notice,) has allowed the pier to remain in an unstable condition ever since, and had it not been for the successful repair lately effected, must finally have occasioned the destruction of a portion of the bridge.

His next proceeding was to inclose the foundation with 12 in. piles, and to rebuild the arches; "the dove-tailed piles were driven all round, close to the bed of timber on which the pier is built, and so deep as to reach about 15 feet under it all round, and afterwards were all sawn off low enough below low water mark, as never to be any obstruction to the navigation of any boat or vessel. Then the two damaged arches were rebuilt the very same in appearance, but with much less material in the inside."

After the preceding extracts, an account of the state in which the pier was found when the water was excluded from the dam, and of the works executed since then to secure its stability, cannot fail to be interesting to our readers.

On the removal of the ground about the pier, the joints of the dove-tailed piling, described above, were found any thing but close, and to make the matter worse, several of the piles had broken in the driving. As no dependence could be placed in this work, new sheet piling, of the same description as that used for the 16 feet pier, was driven all round, enclosing the foundation, thus at once preventing the escape of the finest particles of sand from under the pier. The old piles were afterwards sawn off at a low level, in preference to drawing them, as it was thought their removal might disturb the ground.

During the progress of driving the piles, considerable movement took place in the adjoining arches, showing evident symptoms of further sinking in the pier, and to prevent any injurious effect upon the masonry, strong shoring of whole timbers was fixed from the coffre dam to the soffit of the 64 feet arch, a precaution that has been attended with considerable advantage, as the arch stones have remained nearly uninjured, although several of the mortar joints were broken.

On the removal of the ground within the sheet piling, the projecting part of the timber bottom of the caisson was found to be broken and separated from that part underneath the pier, this had arisen from the space intended for the caisson not having been dredged sufficiently large to receive it, so that it was resting on the slope of the excavation, the centre part being hollow, until the weight of the masonry broke away the sides and allowed the pier to settle on the loose sand and gravel which had run in; the level of the blue clay being nearer the surface at this pier than the adjoining one, the excavation was principally in that material, and its intense stiffness will account for the dislocation that took place in the timber work.

The critical position of this part of the work required much caution, and in applying a remedy to so uncommon a case, we are glad to bear testimony to the most perfect success of the plan adopted; we have no doubt that this pier is *now* as trustworthy as any of the others that have been taken in hand.

The whole of the disturbed foundation timbers were removed, as also all the loose and muddy ground to the solid clay—the depth in some parts being as much as two feet,—under the foundations a body of concrete was filled in, level with the underside of the caisson, and to increase the bearing of the pier, timbers were laid parallel to the sides of the caisson, crossed by others placed 18 inches apart, and inserted to the length of 2 feet 6 inches under the masonry,—to insure their perfect bearing each timber was cut wedge form, and driven tight into the space it was intended to occupy. This operation was continued all round the pier, thus increasing its bearing surface about three feet on each side.

From that level a mass of brickwork was built, backed with concrete to receive the stone work of the pier, which in this case is to form a projecting footing of masonry, and the space within the sheet piling is to be finished with a capping similar to the other piers.

The masons are now employed upon this part of the work, and in extending the pier for widening the roadway, and if we may judge from the number of men employed, and vast store of materials provided, no very long time will elapse before the use of that magnificent temporary work, the dam, may be dispensed with.

We are happy in having had this opportunity of removing the uncertainty and error that has hitherto prevailed about the settling of this pier,—it has always been attributed to the ballast-men lifting gravel too near the foundations, and the late Mr. Telford and others in their plans for securing the piers, had only one object in view, that of preventing any farther scour from the river—in the present instance

we find that there was another and more serious danger to guard against, and that without the assistance of the coffre dam, the sunken pier could *never* have been made secure—on the contrary, that any attempt by driving piles or otherwise, if access could not have been had to the interior might have proved fatal to the adjoining arches.

We hope soon to have it in our power to announce, that the commissioners see that the time has arrived when they may confer a great and lasting benefit on the public, by widening the roadway of the bridge, "a consummation devoutly to be wished," by every one who has occassion to pass over it in its present narrow and crowded state.

ON THE POWER OF THE SCREW.

SIR—Permit me to offer you the following article which I hope you will deem worthy of publication in your Journal.

I am your most obedient servant,

J. R. CUSSEN.

Bruff,
March 30, 1840.

I have been often consulted as to the application of the screw as a mechanical power, and frequently found theory at variance with practice, this led me to an investigation of the rule generally used, for calculating its power, to practical trials of its power, and to an elucidation of a rule different from all those I know to be in use, which I trust will be found correct.

The Rev. Mr. Bridges in his work on Mechanics, p. 284, states, that P : W : : d : cirf. of cylinder, d being in his words the distance between two threads of the spiral, in p. 287, he says that p : W : : d : cirf. of cylinder, and P : p : : cirf. cylinder : cirf. of circle *ex æquo* P : W : : d : cirf. of circle ∴ $W = \frac{2 p a P}{d}$, a = length of lever, but he makes $p = 3 \cdot 1415$, and also p = the power acting on the surface of the cylinder, thus making p in the same equation variable and invariable. In his application of the above formula he uses $p = 3 \cdot 1415$, but omits p = power acting on the surface of the cylinder, he adds in a note (*b*) that P : W : : d : cirf. of the circle. *Whatever be the thickness of the cylinder on which the screw is cut.* He then gives this rule. The power necessary to sustain the weight or produce the pressure will always bear to that weight or pressure, the ratio of the distance between any two spirals of the screw to the circumference of the circle which the power describes, that is $\left(W = \frac{2 p a P}{d}\right)$ the weight to be raised or pressure produced is equal to twice the radius of the lever × 3·1415 × the power applied, and this product divided by the distance between the threads.

The first objection that struck me was why d should represent the distance between the spirals, and not the elevation of the inclined plane, or the elevation or depression obtained by each revolution of the cylinder, this is generally the distance between two threads + the thickness of the thread, or twice the distance between two threads; it is obvious that if the thread be ½ inch, and the distance between the threads ½ inch, that the elevation of the inclined plane, or the elevation or depression obtained at each revolution of the cylinder will be one inch.

The second objection was to the deduced conclusion that the diameter of the cylinder was of no importance, or that a screw of 2 inches diameter was as powerful as one of 12 inches or 100 inches. Suppose that no lever is used, and that the thread is the same in each, say ½ inch, and that the advantage obtained by the inclined plane be calculated we have for the 2 inch diameter screw 1 : 6·283 : : P : W, and for the 12 inch diameter 1 : 37·698 : : P : W, that is, the 12 inch diameter considering it merely as an inclined plane will sustain in equilibrio six times the weight with the same power that the 2 inch diameter screw will sustain.

That this power or advantage could be lost by the application of the same lever is absurd.

The third objection was to multiplying by the circumference of the circle formed by the extremity of the lever, instead of by the radius of the lever, as well may the circumference described by every lever be calculated, the error in calculating the power of the wheel and axle by the circumference would be apparent; in fact a screw is but a revolving inclined plane. Motion and power being communicated to it by a lever; moreover this inclined plane is properly speaking a fox-wedge, that is, two inclined planes of equal height acting on each other, for whatever space the threads of the screw pass over that of the nut, the threads of the nut pass over the same space on the threads of the screw, and both (*i. e.* the threads of the nut and the threads of the screw) sustain equal parts of the weight or pressure.

The power gained by the Rev. Mr. Bridge's formula by taking credit for the circumference of the lever, and dividing by but half the elevation of the inclined plane, is more than lost by omitting the advantage gained by the inclined plane in large screws, and the power of small diameter screws is overrated.

I am convinced that the true basis for calculating the power of the screw is P : W : : d : circumference of cylinder, d being the height of the inclined plane or the elevation or depression obtained by each revolution of the cylinder, then this advantage multiplied by the power applied, and the product divided by the height of the inclined plane, that is,

As the elevation obtained at each revolution, or as the height of the inclined plane,
: circumference of the cylinder,
: : the power applied
: the weight or pressure,

or $W = \frac{P \times \text{circumference of cylinder}}{d}$; the formula most generally wanting in use.

Suppose three screws, each of ½ inch thread, worked by a lever 90 inches long, the lever moved by a windlass of one ton power, the screws to be of 3, 6, and 9 inches diameter, we have the weight raised or pressure produced, by the

							tons.
3 inch diameter screw thus	1	:	9·4245	: :	90×1	:	848·205
by the 6 ditto	1	:	18·849	: :	90×1	:	1696·41
by the 9 ditto	1	:	28·2735	: :	90×1	:	2546·15

By the Rev. Mr. Bridge's formula we have for the three but one power, $W = \frac{2 p a P}{d}$, *i. e.* $W = \frac{2 \times 3 \cdot 1415 \times 90 \times 1}{\frac{1}{2}} = 1130 \cdot 94$ tons.

It is to be remembered that one-third of the calculated power of the screw is lost by friction.

It is my opinion that the screw could be made to supersede the capstan in patent slips and dockyards, and that it could be used to the greatest advantage in submarine operations and excavations: its practical application to these objects will form the subject of another article.

COMPETITION.

SIR—A very suspicious looking advertisement having appeared in the Times of the 12th instant, offering a premium of 20*l.* for designs, estimates and specifications for a church to hold 800 or 1000 persons, to be built at Turnham Green, I applied according to the directions given in the advertisement, for information upon two or three points of some importance, viz. how much money it is proposed to expend—what means the advertisers would take to ascertain that the accepted design could be executed for the estimate which accompanied it—and whether the successful candidate would be employed in case he proved to be an architect of good reputation and experience. In answer to which queries I am informed,

"That the site is level and the soil gravel—
That the expenditure is not to exceed £3,500—
That one-third of the sittings are to be free—
That no vaults are required—
And that these are the only additional particulars the Secretary to the Committee can furnish."

Perhaps you can find room to publish this information for the benefit of the profession.

I am, Sir, your obedient servant,

H. T.

April 19, 1841.

Inclosed is my name and address.

Steam Navigation to the West Indies.—The first of the splendid line of steam packets intended to carry the mails betwixt this country and the West Indies, has been launched from the building-yard of Messrs. Duncan and Company, at Greenock. This vessel, which is 1600 tons burthen, has been named *The Clyde*, and is described as having a most perfect model. Her engines, made by Messrs. Caird and Co., are in readiness, and will be put in without delay. There are at present six of this line of packets, all of the same tonnage, building on the Clyde; four at Greenock, one at Port-Glasgow, and one at Dumbarton; and there is also one at Leith.—*Glasgow Argus.*

REVIEWS.

The Competition for the Nelson Monument critically examined. By JOHN GOLDICUTT.

Thoughts on the Abuses of the Present System of Competition in Architecture, with an outline of a Plan for their Remedy; in a letter to Earl de Grey. By HARRY AUSTIN.

Perhaps no instance that has ever occurred, has shown the utter worthlessness of competition, under the present system, in so strong a light as that for the Nelson monument. The usual cases of fraud and imposition got up by parish officers and attorneys to extract designs from architects without undergoing the ceremony of paying for them, carry each its own stigma; but here is a competition established by a committee of men of unimpeachable integrity, with a sincere desire to elicit a design worthy of the nation, and what is the result? According to the opinion of an honourable and influential member of the committee, Lord Colborne, "there was not a single model or design that came up to what might have been reasonably anticipated, or which would justify the committee in selecting it as a fit and proper monument for so great a man as the hero whose achievements they were anxious to celebrate." Rotten must be the system which could produce such a result under such circumstances, if this judgment were true, or which could permit it, if untrue, to pass without general reprobation; and be it remembered, that the censure includes the design chosen, and now in progress of execution.

It is impossible to deny that the exhibition of the hundred designs and upwards submitted to the committee, was any thing but creditable to the state of British art, and such will be the character of all such exhibitions, as long as a system, or a want of system, is pursued which tends to keep every man who respects himself out of the field. It is certain that a very small proportion indeed of the artists who entered into the Nelson competition were of that class which the committee intended to encourage, and who might have been successfully encouraged with very little trouble; and of those few there is not perhaps one who has not sighed over the loss of his time and labour, which he might have assured himself before-hand would be thrown away. Here is Mr. Goldicutt, for example, who gives us a Jeremiad on the injustice of the Nelson competition. The question is obvious, why had he any thing to do with it, and what did he expect? Did he shut his eyes, his ears, and his understanding to all that was going forward long before the designs were received? Did nothing strike him as deficient or contradictory in the conditions and instructions put forth by the committee, which might have led him to suspect they did not quite understand their own meaning or know their own intentions; or to doubt their competency for what they had undertaken; or did it not occur to him that they had neglected the most ordinary precautions to assist their judgment and to secure fair play to the candidates? and did he make no inquiries to satisfy himself on these points? If he did not, others did, who found their remonstrances and suggestions rejected with the most self-sufficient obstinacy, tempered, it is but just to add, by the utmost courtesy to all applicants on the part of Mr. Scott. And then, why, in the name of common justice, were the competitors encouraged to exercise their invention through every conceivable modification of public memorial, from a simple statue to a full grown temple of Victory, when it was as notorious as the sun at noon day that nothing but a column had the remotest chance of acceptance. Enough had been said at public meetings by the most influential promoters of the scheme, to satisfy any one possessing an average share of observation, that the current set in that direction too strongly to be turned. Why, therefore, did Mr. Goldicutt take the trouble to deliver himself of what he might be very sure would be strangled for a monster in the Foundling Hospital to which it was to be consigned? Upon the taste or wisdom displayed by the committee in deciding upon a column in general, or on Mr. Railton's column in particular, or on any design at all if they were all so bad as Lord Colborne would persuade us, there is no occasion to give an opinion. Whether we consider a column the best of all possible monuments, and Mr. Railton's the best of all possible columns, or maintain the very reverse, in no way affects the conclusion—that gross mismanagement produced a result which seems to have astonished the committee, though it could produce no other, and that a great injustice was committed in not ascertaining beforehand, what was perfectly notorious, that the accepted design would be a column and nothing else, and issuing instructions accordingly. Those who play so recklessly with the labours of architects ought to consider that life is short and drawing paper dear.

For the mischiefs which arise to the profession and the public from the disgraceful state of competition, Mr. Austin steps forth with a string of remedies, every one more futile and inefficient than another, the grand nostrum being that the whole conduct of competitions should be placed under the management of the Institute of British Architects—a proposal very complimentary to the Institute, and one which they would only be doing their duty and carrying out their professions by taking into consideration. But setting aside several objections which occur, it is only necessary to mention one which Mr. Austin seems to have overlooked, viz. that the plenary authority of the Institute must be first recognized by all concerned, or likely to be concerned, and unluckily the parties most dipped in competition (may they speedily have it all to themselves,) are precisely those who are most interested in maintaining the *status in quo*. Besides, suppose the most satisfactory arrangements to be established, no one would be bound to abide by them, as Mr. Austin may see by reference to the Journal for October last, when he will find Mr. Serjeant Talfourd's opinion on the flagrant Bury St. Edmund's case. Nor is Mr. Austin more fortunate in his proposal that the author of a successful design shall, *in every case*, be intrusted with the superintendence of the building. What is to be done if a committee, acting *bonâ fide*, should pitch upon the design of an apprentice, an amateur, or a drawing clerk, or of one of that class of the profession (for, like the law, it is sorely infested with vermin,) who traffic in showy drawings and fraudulent estimates. And the fact is, that the designs of these classes of competitors (we beg to apologize to the three first for naming them with the last,) are precisely those best calculated to catch committees as they are for the most part constituted. Mr. Austin, indeed, goes in the very teeth of his own opinion in this proposal. "It is needless to say," he observes in another place, "that those who send in designs honourably executed, alike fair to their brother competitors and to the committee, which they conscientiously believe can be built for the amount stated, are doomed to experience nothing but vexation and disappointment, and that if they could catch a glimpse of the committee in the very first hour of their sitting, they would most probably see them already sorting their modest designs from the showy and impossible draughts, and laying them aside with the flattering epithet of 'rubbish!'" This is perfectly true, and it is no less so that "the best chance of success under the present system rests with those who, knowing full well the utter ignorance of the men who are to decide on the real merits of the works laid before them, make this their stronghold and anchor of hope. They prepare designs on a scale of great magnificence, which, to carry out in their pristine grandeur, would cost twenty times the stipulated amount. They will be at considerable pains to render prominent the most striking portions of their designs, and to throw a veil over their various defects. They will employ skilful artists to prepare coloured showy elevations, and false perspective views of their principal features, to catch the Committee's unpractised eye; and knowing too well that these designs could not possibly be executed for any thing like the stated estimates, modestly assert, in their accompanying remarks, that much of what they show, (though all in all to their designs, such as they are,) might be omitted without the slightest injury to them. And the committee believe it, because they know no better."

"Is it not wonderful," we still use the words of Mr. Austin, "that so many should be found to engage in contests which experience teaches them are certain to be unsatisfactory and unjustly conducted." It is quite as wonderful that with so just an appreciation of the real state of competition, Mr. Austin should have gone so far wide of the mark in devising remedies.

Did the members of the profession never read the fable of Hercules and the carman? They are just now very much in the case of that same carman, shouting for help with all their might, but with less wit than the boor, for they do not know to whom they are shouting. We are nevertheless competent to give them the same advice that was delivered by the god—that each one should put his own shoulder to the wheel. Very deep they are in the slough, it is true, and a very filthy slough it is—so filthy that from mere communication the whole profession smells of it. Let every one who has not a taste for abiding in the dirt extricate his individual self, and keep cleaner ways for the future. To drop the metaphor, let every member of the profession who respects himself, resolve to enter into no more competitions, unless he is perfectly satisfied, after a strict examination, both with the conditions, and the integrity and competency of those who propose them, and let no one lose an opportunity of exposing in print every case of fraud and falsehood which may come to their knowledge. The example has been set in the pages of this Journal—let it be followed—and when the respectable classes of the profession are shamed out of promiscuous competition, and the public are awakened to the consequences, something may be effected to place the system, which nobody will deny to be thoroughly sound in its original principle, upon a satisfactory footing.—The following notice of a late trial will show how

competition designs are often *got up*, but it is greatly to be lamented that committees are not often so competent and resolute in dealing with them:—

NORWICH ASSIZES.—*April* 7, 1841.

Brown v. *Langshaw*, Clerk.

Early in the year 1837, the parish church of St. Andrew the Great, Cambridge, was found to be in a ruinous condition, and a subscription was raised and a committee appointed for the purpose of rebuilding it. The committee applied to several architects for designs, and five were laid before them, among which that of Mr. Brown of Norwich, was conspicuous for its elegance and ornamental character—so much so, that the committee were not only greatly surprised at the high talent shown by Mr. Brown, in producing a design so superior to those of his rivals, and to any thing which had ever been imagined practicable for so small a sum as four thousand pounds, (the limit set to the expenditure in the conditions accepted by the architects,) but some of them also doubted the possibility of a *mistake* in Mr. Brown's estimate, an accident which does sometimes happen in affairs of this kind. As the architect professed himself to be perfectly clear on this point, his design was accepted and offered for contract. Several respectable builders of Cambridge having declined to compete, two tenders only were obtained, the lowest of which, instead of falling within four thousand pounds, amounted to something like six!—a dilemma which the architect was quite prepared to meet by altering his design so as to bring it within the prescribed limits. The majority of the committee (which was not composed exclusively of parish officers), being however troubled with a prejudice that such a course of proceeding might not be altogether just to the other parties who had expended their time and labour upon the faith of the conditions under which they were invited to compete, came to a resolution to dismiss Mr. Brown, who thereupon brought an action against the chairman, the Rev. Mr. Langshaw, to recover the sum of £300 and upwards, for preparing his designs. After keeping this action hanging over the heads of the committee for nearly four years, it has at length been tried as aforesaid, and upon the facts proved by the plaintiff's own evidence, the learned judge stopped the case, and a verdict was found for the defendant.

Observations on Railway Monopolies and Remedial Measures. By ALEXANDER GORDON, M. Inst. C.E. London: Weale, 1841.

Mr. Gordon is particularly known to the public for his great exertions for the introduction of the steam carriage on the common road, it is not perhaps so well known that he labours under a railway phobia, which is the cause of the production of the present pamphlet. This like all Mr. Gordon's works abounds with much that is valuable, but it is so tinctured with the expression of his prejudice against the railway system, that much of the weight of his remarks is counteracted. His zeal for the welfare of his profession is a prominent feature in his character.

Peckston on Gas-Lighting. Third Edition. London: Weale, 1841.

Mr. Peckston has been before the public for the last twenty years as a writer on this subject, so that we may fairly conclude that his merits must be pretty well known without any commentary of ours. We have now another edition of his work, embodying all the recent improvements, and abounding with all that extent of illustrations, which makes Mr. Weale's merits as a publisher of engineering works conspicuous. We do not recommend our readers to buy Mr. Peckston's book, because we know that if they want to acquire any information as to gas-lighting they must refer to him.

On Harbours. By W. A. BROOKS. London.

Mr. Brooks's work contains much that is new and valuable, it requires however more consideration on our part before we can adequately discuss the views put forward. In the meanwhile the engineering student may with advantage refer to this volume, which has evidently been written by a man of research and ability. It contains some good information as to the views entertained by French and Italian engineers.

A New Treatise on Mechanics. By the Author of a "New Introduction to the Mathematics." London: Whittaker & Co., 1841.

This is one of those laudable attempts to simplify a subject too often mystified, which is well deserving encouragement. The public are sure to gain by attempts of this nature, for though new errors may sometimes be introduced, more is gained by the removal of old ones.

Map and Section of the Brighton Railway. By J. R. JOBBINS. London: Grattan and Gilbert, 1841.

This map the scale of three miles to an inch, includes the whole of the Greenwich, Croydon, Brighton, Blackwall, West London and Thames Haven lines, the South Eastern to beyond Tunbridge, the Eastern Counties to Chelmsford, the Northern and Eastern to Broxbourne, the Birmingham to Tring, the Great Western to Maidenhead, and the South Western to Woking, with the country 25 miles north of London, 45 miles south, and 30 miles east and west, including the course of the Thames and the country between Windsor and Chatham. It seems to be executed with great accuracy, and for cheapness and extent of information is highly valuable, being equally useful either as a railway or general map. Appended to it are sections of the Croydon and Brighton lines, showing also by a novel plan the surrounding country.

Davies's Map of London and its Environs.

Mr. Davies's map includes all the recent improvements in the neighbourhood of London, giving the cemeteries, railway stations, and other matters. It includes the boundaries of the metropolitan borough, and much other useful information, so as to serve equally as a map of London and of the surrounding country.

MOTIVE POWER FOR IMPELLING MACHINERY.

Henry Pinkus, Esq., late of Panton-square, Coventry-street, but now of No. 36, Maddox-street, Regent-street, Middlesex, for improvements in the methods of applying motive power to impelling machinery, applicable, amongst other things, to impelling carriages and vessels, and in the methods of constructing the roads on which carriages may be impelled, enrolled March 24, 1841.

One of the improvements to which the patentee lays claim is what he terms the differential railway. It consists of a double line of railway, on which, at certain distances, is affixed a gas-explosive apparatus, described in the specification of a former patent obtained by him, provided with two large horizontal wheels, one above the other, round each of which an endless metal band passes; and between each apparatus thus described is an intermediate apparatus, provided also with a pair of wheels. The band proceeding from one of the horizontal wheels passes round one of the wheels of an intermediate apparatus placed in one direction, whilst the band from the other horizontal wheel passes round one of the wheels of an intermediate apparatus placed in the opposite direction.

The bands pass over wheels placed in the centre of each line of rails, and put those wheels in motion, which motion is communicated to the train of carriages by means of bars extending from the bottom of the same, and which are kept in contact with the wheels.

Another of the patentee's improvements is for a mode of propelling boats on canals by "gaso-pneumatic" power. Along the whole length of a canal, on one or both banks, a suspension rail is constructed, and along the canal, in a line with the rail, is laid down a gas main. On the rail is suspended an impelling machine, which consists of a frame running on wheels, and provided with two horizontal pulleys, round one of which an endless band passes from a pulley in the boat to be impelled, and in which is placed the gaso-pneumatic explosive engine. This engine actuates the pulley in the boat, which by means of the endless band communicates its motion to the horizontal pulleys, and they in turn communicate it to the running wheels, and cause the impelling machine to move onward and impel the vessel. Another mode of applying power on canals consists in using a steam engine in place of the gaso-pneumatic engine, to give motion to the impelling machine; and in order that boats may travel in opposite directions with only one line of rails, the impelling machines are made to move over one another when they meet, and so proceed on their respective courses.

The following is a mode of constructing roads or ways, also included in this specification:—In a given area of land a station is erected in a central situation, in which is placed an electric battery or batteries; or wells or tanks are constructed in any part of the said area. From the station, or from any of the tanks, a system of mains or pipes is laid down, and all along these, at intervals of from one to two hundred yards, are erected short vertical branches, terminating in a box with a moveable lid. In the mains are laid continuous metallic wires, and these wires are so arranged that when their ends at the station or tanks are brought into contact with the positive and negative poles of a battery, they constitute metallic circuits.

In order to put implements into action by means of this power, the patentee uses a locomotive engine similar to that described in the former specification, except that the cylinders, piston-rods, and their appurtenances are dispensed with, and the drum may be of smaller dimensions. Round this drum is coiled a pair of wires, and these are attached to a similar pair in one of the boxes before mentioned. To the locomotive engine an electro-magnetic engine is applied, and, in order to set the former in motion, chemical action is induced in the batteries at the station or tanks, and electrical influence is thus generated, the force of which, acting through the metallic circuit, will put the impelling engine in motion.

The patentee uses the electric power to prevent the collision of trains on railways, by causing it to put the breaks of carriages into action; he also attaches an electric battery to the locomotive engine, so that when trains are approaching each other, the battery being brought into action will, by means of connecting wires, apply the breaks, pull the lever of the whistle, and shut off the steam.

The patentee also shows a mode of constructing engines, and of actuating them by means of electric power.

The electric power is also used for lighting railways, tunnels, roads, &c.

An electric glow or "brush" is effected at the place required to be lighted, and being placed in the focus of reflectors, yields rays of light, which may be made revolving lights for night signals, &c.

In addition to the numerous improvements included in this specification, already noticed, there is one for a fire-engine to be worked by the "gaso-pneumatic power," to be drawn from the gas mains in the streets where the fire occurs, in the same manner as the water. [This specification occupies fifteen sheets of parchment, and there is also a corresponding number of drawings.] —*Inventor's Advocate.*

STEAM NAVIGATION.

THE NIGER EXPEDITION.

The expedition about to leave this country, to explore the River Niger, and which has excited such intense interest, consists of three iron steam vessels under the command of Captain Trotter, an intelligent and experienced officer of Her Majesty's navy. The two larger ones, the "Albert" and the "Wilberforce," are each of 440 tons burthen and 70 horses' power; and the smaller one, the "Soudan," (intended to act as a pilot vessel,) admeasures 250 tons, and has an engine of 35 horses' power. The two first are schooner rigged, and are remarkably fine-looking vessels, with lofty spars, and will display a large spread of canvass to the favouring breeze. They are fitted with Captain George Smith's method of stowing boats to form part of the paddle boxes, in addition to the usual complement of boats. They are heavily armed, and will each carry a number of Kroomen (a class of men accustomed to the climate, and found to be of eminent service), besides an efficient man-of-war's crew; and altogether, will prove formidable opponents should the natives venture to molest them, as they did the last expedition, under Messrs. Laird & Oldfield.

The interiors of the steamers are replete with every convenience, and even luxury, which can be desired. They are furnished with Dr. Reid's ingenious system of ventilating tubes (a kind of air filter) for the purpose of supplying fresh air in the 'tween decks; and which contrivance, it is confidently expected, will prove of great utility in protecting the crews from the debilitating effects of the noxious vapours which infest the vicinity of the River Niger, and which have hitherto rendered that climate so dreadfully fatal to Europeans. From their light draft of water they will be enabled to ascend a considerable way up the river, should they be so fortunate as to escape running hard aground, as from their great size it would be a difficult matter to get them off, especially should the crews suffer from the climate. The last expedition incurred great delays from the vessels continually getting aground; yet they were much easier got off than these would be from their being of smaller dimensions.

In conclusion we wish them every success, and must say that an expedition better calculated to fulfil its purpose never left the shores of this, or, indeed, any other country.

A comparison of the dimensions and draft of water of the steamers comprising the last and present expeditions, may afford an idea of the advanced state of steam naval architecture since the year 1832.

Last Expedition.		Present Expedition.	
Quorra.	Alburkah.	Albert and Wilberforce.	Soudan.
Length .. 112 ft.	.... 70 feet	.... 130 feet	.... 110 feet
Breadth .. 16	 13	 27	 22
Depth .. 8	.... 6½	 10	.... 8½
Horses power 40	 16	 70	 35
Draft of water 6 ft	.... 4¼	.... 5¾	 4
Built of timber.	.... Iron.	.... Iron.	.... Iron.

The vessels of the present expedition were built by Mr. John Laird, of North Birkenhead, Liverpool, and the engines by George Forrester & Co., of Liverpool.

Auxiliary Steam Power.—We have to announce the departure for India, during the last month, of the "Isabella Blyth," a ship of 500 tons burden, fitted with a pair of small engines and paddle-wheels, to be used during calms and light winds, which, it has been ascertained on statistical data, prevail, on an average passage to or from India, during full one third of the time occupied by the whole voyage. To overcome this very serious difficulty, and ensure regular and rapid passages, the splendid class of vessels which now constitute our mercantile navy, appear to require nothing more than the successful application of steam power as an auxiliary. In order to prevent the great loss of power and increased liability to derangement resulting from one paddle wheel being immersed too deeply in the water when the ship is listed over, (while the other would consequently be entirely out of the water,) and also to elevate and depress the paddle wheels to suit the immersion of the vessel, which will, of course, vary not only with different descriptions of cargo, but also by the consumption of fuel, water, &c., during a voyage; the paddle wheels are fitted in such a manner that either wheel may, by the power of one man, be raised or lowered as occasion may require without stopping the engines. The greatest advantage will thus be taken of every breeze of wind, without any sacrifice of the auxiliary power. We feel assured that the ordinary paddle wheels which have, up to the present time, proved superior to every other propeller, only required this adaptation to render their application to sailing vessels perfect, and we therefore anticipate a very favourable result.

This vessel left the London Docks the latter part of last month, drawing 17ft. 6in. water, and after encountering more than the usual obstructions of the Pool, and proving in all her movements to be completely under the control of the steam power, the paddle wheels were adjusted to the proper depth of immersion, and the distance to Gravesend was performed in about four hours and a half. With the exception of a topsail being set during about twenty minutes, no advantage was taken of the sails.

Distinguishing Signal for Steam Boats.—We have been gratified, in common with a considerable number of steam-boat owners, captains, and others interested in steam navigation, by being shown a signal which will most admirably effect an object most desiderated, that of distinguishing steam vessels from sailing vessels at sea, and go far to prevent unhappy collisions and the destruction of human life. The inventor is Mr. Francis Melville, Buchanan Street, who, from a praiseworthy desire to promote the general safety, has devoted much of his time to the subject. Mr. Melville's plan is to place in front of the funnel of the steamer a lamp, with a clear light, and a strong reflector, having an external sliding cover attached to its face, so fitted as completely to obscure the light within, but to be made to move up and down the whole length of the lanthern, by means of a rod affixed to a small lever power connected with the engine, so that the motion or alternations of the slider would be at the rate of twenty in a minute. At the bottom is to be added a flat sole, made so as to carry the rays of light completely over the side of the vessel, in order that the reflection from any object on deck may not interfere with the pilot. By means of this simple apparatus, a signal will be produced perfectly distinct from any other known in navigation, and by means of it a steamer will, at the first sight, be known from any other vessel. Though the exhibition which we had the opportunity of observing was necessarily imperfect (being displayed from a window), enough was, nevertheless, witnessed to show at once the perfect practicability and adaptation of the signal to the purpose intended.—*Glasgow Argus.*

Sixteen war-steamers are ordered to be built, six of the first class and ten of the second; all to be armed with guns of 10 inch calibre. Several of these will be laid down immediately, and the frames of the whole converted without delay, so as to be ready against the engines are prepared.—*Naval and Military Gazette.*

The Royal West India Steam Navigation Company have resolved to build six additional steamers. From the high recommendation given to the Clyde ship-builders by the Government inspectors, who have inspected the steamers now on the stocks, we understand that a few, if not the whole, of the additional steamers will be constructed on the banks of the Clyde. Three additional steamers are about to be contracted for by the Cunard Atlantic Steam Company.—*Glasgow Chronicle.*

The Mammoth, building by the Great Western Ship Company, at Bristol, will exceed 3,000 tons (about 600 more than any other ship in existence). The saving of room by her being built of iron will admit of her carrying coals for both the outward and home voyages, a matter of much importance from the inferior quality of American coal. Her engines are of 1,000 horse power. She will be enabled to carry an unusual quantity of canvass, and is expected to make the passage of the Atlantic in ten days.—*Liverpool Advertiser.*

MISCELLANEA.

The Duke of Wellington's Statue.—This colossal equestrian figure is rapidly progressing under the hands of Mr. Wyatt. When completed, it is expected to weigh about 50 tons, and to stand about 32 feet from the pedestal. If possible, it is to be formed entirely of the cannon taken by his Grace. The model of the horse, which is about half finished, is very fine. The gigantic animal, with eyes extended and nostrils inflated, is breathing with animation and vigour. The head and boots of the Duke are already cast. The face is an admirable likeness, as is well known to all who had an opportunity of seeing the model of it last year. These parts of the figure, which are all at present completed, have taken the metal of a single cannon. The lower extremities of the figure will be of solid bronze, the thickness gradually diminishing in the upper parts. It is said that the committee have appointed two years as the period in which the work should be completed, 11 months of which have already transpired, but it seems almost premature to fix a time for the finishing so elaborate and gigantic a work, especially when the process of casting is attended with so many risks that may cause a temporary impediment to its progress. During his labours Mr. Wyatt has acquired much valuable experience calculated to advance the art of casting in metal, among which are a method for testing the tubes which supply the metal to ascertain that they are perfectly clear, and a plan with the air tubes that causes them not only to expel the air, but also to operate as suction tubes to the metal, and promote its distribution. Another ingenious contrivance is a set of instruments, invented by Mr. Wyatt, for clearing off the metal with infinitely less labour than a common hand-instrument. This Wellington statue, when finished, will, it is supposed, be the largest hitherto known.

Primrose Hill, Regent's Park.—The Commissioners of Woods and Forests have, we understand, concluded an arrangement with Eton College, by which Primrose-hill will be preserved from being built upon. This place of healthful resort will therefore remain to the inhabitants of the metropolis, as one of the "lungs of London."

Artesian Well at Southampton.—The works on this important and spirited undertaking have been resumed; but after working one of the engines about ten hours, an accident occurred by the breaking of the fly-wheel shaft of the north engine—the cause of which it appears is not as yet accounted for. It seems that by the present arrangements immense quantities of water can be raised from the shaft to the surface, as, with only one engine and one pump at work, and those working only at one half the speed to which the engine is equal, the quantity of water delivered from the pump nozzle exceeded 12,000 gallons per hour; and this, too, when the water to be raised was upwards of 150 feet from the surface level. The present depth of the shaft is 300 feet, the excavation for a large portion of which is upwards of 16 feet diameter. We have reason to believe that for the purpose of obtaining a supply of water, there has been no other shaft constructed of so large a diameter, or with such durable material, for so great a depth. The difficulties encountered in sinking the shaft thus far have been of no ordinary kind, notwithstanding which, no one engaged in the undertaking appears to be discouraged. On the contrary, each misfortune appears to excite fresh exertions. The commissioners and contractors have decided to sink the shaft to a much greater depth, which, in our opinion, is far preferable to the plan of boring to so great a depth as was originally intended. We heartily wish the undertaking every success, but whatever the result may be, the inhabitants of Southampton will, by this work, solve the important problem, whether or not a copious supply of good water can be obtained by sinking a capacious shaft in a basin geologically situated as is their increasing town, and as is also similarly situated, the great metropolis with its suburbs.—*Hampshire Independent.*

LIST OF NEW PATENTS.

GRANTED IN ENGLAND FROM 29TH MARCH, TO 27TH APRIL, 1841.

Six Months allowed for Enrolment.

JAMES TILDESLEY, of Willenhall, Stafford, Factor; and JOSEPH SANDERS of Wolverhampton, Lock Manufacturer, for "*improvements in locks.*"—March 29.

GEORGE EVANS, of Dorset Place, Marylebone, for "*an improvement or improvements upon trusses, for the relief of hernia.*—March 29.

ALEXANDER PARKES, of Birmingham, Artist, for "*certain improvements in the production of works of art in metals, by electric depositions.*"—March 29.

JOHN LINDSAY, of Lewisham, Esquire, for "*improvements in covers for water-closets, night-stools, and bed-pans.*"—March 29.

JAMES FURNIVAL, of Warrington, Carrier, for "*an expeditious mode of unhairing, mastering, and tanning various descriptions of hides and skins.*"—March 29. (Four months.)

THOMAS GORE, of Manchester, Machine Maker, for "*improvements in machinery or apparatus for roving, spinning, and doubling cotton, silk, wool, and other fibrous materials.*"—March 30.

JOHN ORAM, of Chard, Somerset, Machinist, for "*improved machinery or apparatus for making or manufacturing netted fabrics.*"—March 31.

WILLIAM JENKINSON, of Salford, Machine Maker, for "*improvements in machinery for preparing and spinning flax, silk, and other fibrous substances.*"—March 31.

JOSEPH GAURY, of Watling Street, Warehouseman, for "*a parachute to preserve all sorts of carriages using axletrees from falling or injury, upon the breaking of their axle-trees.*" A communication.—March 31.

JOHN GEORGE BODMER, of Manchester, Engineer, for "*improvements in the construction of screwing stocks, taps, and dies, and certain other tools or apparatus or machinery for cutting and working in metals.*"—April 3.

JAMES OGDEN, of Manchester, Cotton Spinner, and JOSEPH GRUNDY WOOLLAM, of Manchester, aforesaid, Commission Agent, for "*improvements in looms for weaving.*"—April 3.

WILLIAM EDWARD NEWTON, of Chancery Lane, Civil Engineer, for "*improvements in the process, mode, or method of making or manufacturing lime, cement, artificial stone, and such other compositions, more particularly applicable for working under water, and in constructing buildings and other works which are exposed to damp.*" (A communication.)—April 3.

ZACHARIA BRYANT, of the town of Nottingham, Machinist, for "*an improved method of manufacturing cloth and other fabrics from woollen, cotton, flax, silk, and other substances.*"—April 3.

JAMES ANDERSON, of Newcastle-upon-Tyne, Engineer, for "*improvements in windlasses.*"—April 5.

WILLIAM JAMES BARSHAM of Bow, Gentleman, for "*improvements in fastening buttons and other articles on to wearing apparel, and other descriptions of goods or manufactures.*"—April 5.

HENRY M'EVOY, of Graham Street, Birmingham, Hook and Eye Maker, for "*improvements in fastenings for bands, straps, and parts of wearing apparel.*"—April 5.

JONATHAN BEILBY, of York, Brewer, for "*improvements in brewing.*"—April 5.

WILLIAM HUTCHINSON, of Sutton and Trent, Nottingham, Seed Crusher and Oil Cake Manufacturer, for "*improvements in the manufacture of oil-cake or seed-cake.*"—April 5.

WILLIAM LITTELL TIZARD, of Birmingham, Brewer, for "*improvements in apparatus for brewing.*"—April 5.

JOSEPH WILSON BUTTALL, of Belper, Draper, and HENRY HOLDER, of the same place, Tailor, for "*improved apparatus to be attached to trowsers, commonly called trowser-straps.*"—April 5.

JOSEPH APSEY, of Cornwall Road, Engineer, for "*improvements in the construction of flues for steam-boilers and other furnaces.*"—April 6.

CHRISTOPHER EDWARD DAMPIER, of Ware, Gentleman, for "*improvements in weighing-machines.*"—April 15.

FRANK HILLS and GEORGE HILLS, of Deptford, Manufacturing Chemists, for "*improvements in the manufacture of sulphuric acid and carbonate of soda.*"—April 15.

HENRY AUGUSTUS WELLS, of Saint John's Wood, Gentleman, for "*improvements in the manufacture of woollen cloths.*"—April 17.

PETER KENDALL, of Gifford's Hall, Suffolk, Esquire, for "*an improved method or methods of connecting and disconnecting locomotive engines and railway carriages.*"—April 17.

JOSEPH BARKER, of Regent Street, Lambeth, Artist, for "*improvements in measuring aeriform or fluid substances.*"—April 20.

JOSEPH BENTHAM, of Bradford, Weaver, for "*improvements in weaving.*"—April 22.

HENRY BROWN, of Codnor Park Iron Works, Derby, Iron Manufacturer, for "*improvements in the manufacture of steel.*"—April 22.

THOMAS HARRIS, of Hales Owen, Birmingham, Horn-Button Manufacturer, for "*improvements in the manufacture of what is called horn buttons, and in the dies to be used in the machinery of such descriptions of buttons.*" (Partly a communication.)—April 22.

HUMPHREY JEFFERIES, of Birmingham, Button Maker, for "*improvements in the manufacture of buttons.*"—April 22.

JOHN ROSTRON, of Edenfield, Lancaster, Manufacturer, and THOMAS WELCH, of Manchester, Manufacturer, for "*improvements in looms for weaving.*"—April 22.

FLORIDE HEINDRYCKX, of Fenchurch Street, Engineer, for "*improvements in the construction and arrangement of fire-places and furnaces, applicable to various useful purposes.*"—April 24.

LANCELOT POWELL, of Clydach Works, Brecon, Ironmaster, and ROBERT ELLIS, of Clydach, aforesaid, Agent, for "*improvements in the manufacture of iron.*"—April 24.

THOMAS ROBINSON, of Wilmington Square, Gentleman, for "*improvements in drying wool, cotton, and other fibrous materials in the manufactured and unmanufactured state.*"—April 27.

WILLIAM PETRIE, of Croydon, Gentleman, for "*a new mode of obtaining motive power by voltaic electricity, applicable to engines and other cases where a motive power is required.*"—April 27.

ALEXANDER SOUTHWOOD STOCKER and CLEMENT HEELEY, both of Birmingham, Manufacturers, for "*improvements in patten and clog ties, and other articles or fastenings of dress.*"—April 27.

BENJAMIN RANKIN, of College Street, Islington, Gentleman, for "*a new form and combination of, and mode of manufacturing blocks for pavement.*"—April 27.

OSBORNE REYNOLDS, of Belfast, Ireland, Clerk, for "*improvements in paving streets, roads, and ways.*"—April 27.

ANDRE DRONOT DE CHARLIEN, of Coleman Street Buildings, Gentleman, for "*improvements in preparing matters to be consumed in obtaining light, and in the construction of burners for burning the same.*" A communication.—April 27.

TO CORRESPONDENTS.

Maplin Lighthouse appeared in the last month's Journal.

Steam Engines in America will appear next month.

We are compelled to postpone several papers until next month; we must earnestly request of our numerous correspondents to favour us with their communications as early in the month as they possibly can, so as to ensure insertion.

Warming Buildings with Warm Water.—*We have received a communication from Mr. Richardson, and also an answer by Mr. Perkins to Messrs. Davies and Ryder's Report, given in last month's Journal, we very much regret that we are compelled to postpone both of them. We do not think it exactly correct to attack the report, until the experiments promised by Mr. Perkins are tried, we shall feel much pleasure in attending such experiments, and giving a faithful report of them, as we consider it a question of such great importance that it ought to be decided by facts and not by arguments.*

Communications are requested to be addressed to "The Editor of the Civil Engineer, and Architect's Journal," *No. 11, Parliament Street, Westminster.*

Books for Review must be sent early in the month, communications on or before the 20th (if with drawings, earlier), and advertisements on or before the 25th instant.

Vols. I, II, and III, may be had, bound in cloth, price £1 each Volume.

The Kursaal Gebäude at Brückenau

SECTION.

PLATE 5

The Kursaal Gebäude at Brückenau.

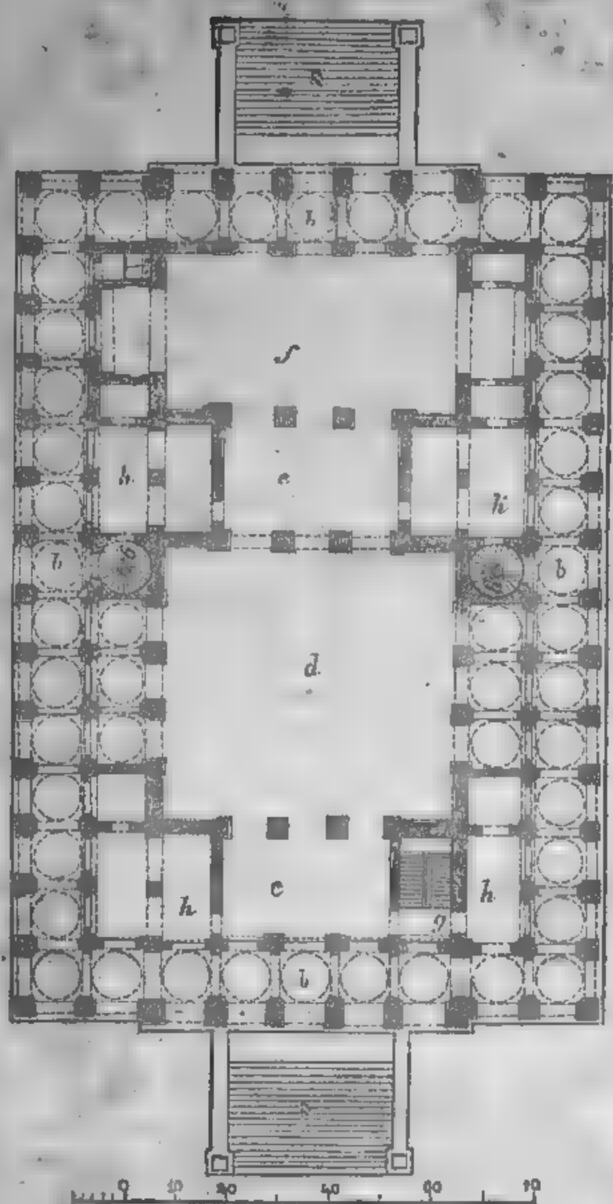
ELEVATION.

Scale of Feet.

THE KURSAAL GEBAUDE AT BRÜCKENAU.

(With two Engravings, Plates V. and VI.)

Plan of Principal Floor.



Scale of feet.

a, steps; *b*, loggia; *c*, entrance hall; *d*, dining hall; *e*, intermediate hall; *f*, ball room; *g*, staircases; *h*, cloak and audience room.

It will not diminish the interest of the subject to our readers to know that, in his "Spas of Germany," Dr. Granville speaks of the *Kursaal* at Brückenau, in the following highly complimentary terms. "This is another of the great architectural works of which Bavaria may well be proud, and the idea and design of which were suggested by the King himself. It is the handsomest building of the kind I have seen in my general excursions in the Spas of Germany, and its various decorations are equal to any of the most exquisite productions of the Bavarian artists. On the right a grand flight of stairs leads to the king's gallery. The pavement is tessellated, and the *plafond* richly painted in stucco. From it depend five gigantic lustres which are said to give to the interior, on gala nights, the splendour of sunshine, lighting up every part of a building which for loftiness, daring proportions, and dimensions is such as an English people seldom witness in their public edifices. It is the production of Gutensohn,* a native of Lindenau in Switzerland, who having shown when very young, and at Munich, a considerable taste for architectural drawing, the King of Bavaria sent him at his own expense to Italy and Greece, to complete his studies. He is now residing at Wurzburg, and is employed in public works on account of the crown. I did not ascertain what such a public building might have cost in Bavaria, but it would be easy to calculate what sum would have come out of the Exchequer in this country, were such a one to be attempted."

So far the Doctor,—who at the time he wrote his description, had no idea that it would be tested by being confronted with any drawings of the edifice itself, or he would probably have expressed himself rather more cautiously, for as far as mere design is concerned, there certainly is nothing remarkably striking in the exterior of the building; it is in a good though simple style, and possesses a certain propriety of character; besides which it has the advantage of being insulated, and of strict consistency being kept up in every one of its elevations. It should also be borne in mind that much of the effect attending the building itself—of the play of perspective and of light and shade produced by the open arcades enclosing the whole of the lower part above the basement,—is necessarily lost when the design is exhibited only in separate geometrical drawings. On the other hand, we are of opinion that consistency and uniformity have been pushed somewhat farther towards monotony, than there was any occasion for; and that the design would have been improved by having a little more variety thrown into it. Neither is the building at all remarkable for its size, the extreme dimensions being only 112 by 165 feet English.

In fact we must presume that Dr. Granville's admiration was excited chiefly by the interior and the style of its decoration, but we think that he has there also a little magnified some circumstances,—for instance when he tells us of a grand flight of stairs leading to the king's gallery; because the plan shows that staircase (*g*) to be a very confined space. Still there is undoubtedly much architectural grandeur and considerable scenic effect in the *Saal* or saloon itself, which rises the entire height of the building, and which may be said to occupy nearly the whole of the ground floor, the *Tanzsaal* or ball-room being in continuation of the other, though less lofty, and divided from it only by an intermediate compartment (*e*) having three open arches towards either of the other rooms. The decorations of the larger saloon, which is used as a dining or banqueting room, and of which a large perspective view is now lying before us, exhibits a tasteful application of the Renaissance style, or rather that of the Loggie of the Vatican. The deep and spacious royal tribune or loggia which is seen through three open arches in the upper part of the saloon, must have a strikingly splendid and scenic effect. As regards this portion of the interior, generally, we are of opinion that it contains much which would be exceedingly appropriate and applicable for the interior of an Exchange, with a covered area, lighted from above through a series of lunettes or semicircular windows (which might be left unglazed) just below the ceiling.

To quit these remarks of our own—which ought perhaps rather to have followed than preceded explanatory description, we return now to the latter. The building, begun in 1827, and completed within four years, stands upon a gentle declivity, in a beautiful valley, at no very great distance from the mineral spring, and from the baths and lodgings for visitors at the Spa. The edifice is raised upon a stylobate or low rusticated basement, containing the kitchens, cellars, and other offices, with the requisite accommodation for the domestic part of the establishment; which rooms are about 12 feet high, the floor being about four or five feet lower than the ground level. A flight of steps (*a*) at each end or front of the building leads up to the open loggia which forms a covered terrace quite around it, where the visitors can promenade, and enjoy the surrounding scenery. This loggia (*b b*) consists externally of 46 arches—viz. 14 on each of the longer, and 9 on each of the shorter sides or fronts,—and internally of 42 square compartments covered by as many small segmental domes. The larger Saloon or Dining Hall (*d*) is 54 feet (English) square, and 44 high; and its ceiling which is flat, has a cove intersected or divided into spandrils by the lunettes or arched spaces over the upper windows groining into it. Both the ceiling itself and those spandrils are richly decorated, as are likewise the panelled pilasters between the windows and upper arches, and also the podium upon which they rest. In its lower part or floor-plan, this Hall is greatly extended by the recesses or additional compartments, with which it is connected by three open arches on each side, and including which the dimensions become 98 feet English in the longitudinal, and 82 in the transverse direction of the plan. The *Tanzsaal* or Ball-room (*f*) measures 56½ by 30 feet, or including the recesses at its ends, the total length is 80½ feet. This room is very differently proportioned from, and by no means so lofty as the other, (which approaches to a cube), the height here being 26 feet, or 18 less than that of the other.

* Johann Gottfried Gutensohn was born at Lindenau, on the Lake of Constance, in 1792. In conjunction with Knapp, he published a work on "Basilicas," 1822-6; and afterwards with Thurmer, another on the Italian architectural decoration of the 15th century. In 1832 he proceeded to Greece, as architect to King Otho.

The exterior of the building is entirely of wrought stone, of a quartz-like species, and of an exceedingly hard kind. Taken therefore altogether,—considering the solidity of its construction, the regularity of its design, and the richness of its internal decorations, this edifice is a very superior one of its class, and although of no very great extent, fairly deserves to be considered as a "monumental" production of the art.

CANDIDUS'S NOTE-BOOK.

FASCICULUS XXVII.

> "I must have liberty
> Withal, as large a charter as the winds,
> To blow on whom I please."

I. SEEING what Mr. Barry has done in the two Clubhouses designed by him in Pall Mall, methinks people might by this time perceive how much more might be accomplished by carrying on to a greater extent the same mode of treatment, and making the dressings to the windows not only finishings to those apertures, and proportioned to them, but so to be in a manner proportioned to the whole design, and to become important decorations of it. At present, though their mouldings may occasionally be richer than usual, there is little variety in the design of windows—little at least, in comparison with what there might be,—as regards composition and general character, such dressings consisting of no more than an architrave around the aperture, surmounted by frieze and cornice—either with or without the addition of pediment; or if something more than this be required, it is obtained by either small columns and pilasters. Yet wherefore should we confine ourselves to that as the very *maximum* of decoration allowable for such features, when window-dressings may be treated arbitrarily, that is, with artistical freedom instead of being invariably only the *echoes* of the parts belonging to a large order? Of course, one objection will be that they cannot be at all exaggerated without producing heaviness; another that the doctrine of arbitrary treatment, is nothing more than that of universal license—which would soon be universal architectural licentiousness. But according to the first objection, the cornicione of the Reform Clubhouse, ought to be offensively heavy, for it certainly may be characterized as being exaggerated. And with regard to the second, it would be better to run the risk of being scandalized by a little licentiousness in design now and then, out of fear of it—than to doom ourselves to what, if not exactly monotonous insipidity, excludes a great deal that would be good though of a different kind of merit. Most assuredly there is no danger whatever of our Anglo-Athenian school falling into any excesses as regard the decoration of windows or any thing else. No need to caution them against giving the reins to their imagination, and indulging in architectural frenzies. Their buildings may be chaste—for as the man said of his Aunt Deborah, they are so confoundedly prim and ugly that their chastity is proof against all suspicion.

II. Theodore Hook seems to entertain about the same kind and degree of affection and admiration for Railways, as I myself do for Palladio, or *caro mio* Bartholomew does for architectural competition. Whenever he can, Hook is sure to have a slap at the unfortunate Railways: witness among other instances the following comparison:—"it must as inevitably annihilate their hopes as the *incidental* tumble of a train off the railway settles the fate of the infatuated passengers of the iron hearses invented for the purpose of cheatery and monopoly, to supersede good old English horses and carriages, and the best roads for travelling in the world"! Most undoubtedly travelling by those 'iron-hearses' is not quite so aristocratic, dignified and luxurious as posting a journey in a chaise and four, preceded by a courier; still for the million the newer system has doubtless its advantages—vulgar ones though they be—or it would never have been encouraged to the extent it now is. When people can afford it, it is all very well for them to give themselves as many consequential and impertinent would-be-fine airs as they please; but is not Hook himself the driver or *conducteur* of a literary omnibus, started professedly *pro bono publico*, and always ready to *take in* and to be taken in by as many readers as it can obtain—the more the merrier?

III. S. L. has my hearty leave to inveigh against the application of Gothic to modern domestic buildings, if by Gothic he understands such frightful absurdities as was the so-called Gothic Dining-room at Carlton House, which had a flat ceiling—painted to imitate sky and clouds—just over one's head, and ugly brackets for lamps attached to it! It is said that that more astonishing than admirable specimen of taste was concocted by the united genius of George IV. and Messrs. Nash and Soane. What a triumvirate of talent!—worthy of Bartlemy Fair. Never was man more innocent of any feeling for grandeur in architecture than was that his 'Most Gracious Majesty.' There certainly is no royal road to taste; but then if he happens to have none himself, a prince should know where it is to be purchased ready-made, and take care that he be not imposed upon by Brummagem counterfeits,—and poor John Nash's taste was Brummagem to a degree it is now most mortifying to reflect upon. The time—so we are assured—will come when Brummagem alias Buckingham Palace, will have justice done to its merits; which time will arrive when it is pulled down, and not a day before. There is indeed one purpose to which it might properly enough be converted, viz. to that of a Royal Nursery, because in such a case the babyishness of its architecture would be in character.

IV. By no means is it uncommon to hear sneering remarks on the folly of those who build beyond their means, yet for one man of fortune who so dips his property, there are fifty who impoverish or embarrass themselves by other extravagances of various kinds, which escape censure either because they are more like the follies of other people, or because instead of showing themselves to the world as a single *corpus delicti*, they are a legion—inconsiderable when taken separately, although collectively most formidable. After all there may be a great deal of what the world calls extravagance, combined with true economy, and *vice versâ*. Our own times afford a splendid instance of what may be accomplished by magnificent economy. See what Louis of Bavaria has done for Munich, and for every branch of the fine arts in that petty capital! In this country had it been proposed to do but half as much, people would have cried out, Impossible! Had John Bull been asked to furnish two millions for a royal palace that would have been an honour to the nation, John would have turned confoundedly sulky, and buttoned up his breeches pocket in a huff. However John is liberal in his way, and also likes a bargain, therefore does not grudge half that sum to erect what is a disgrace to the country; flattering himself all the while, poor dupe!—that whatever be said of his taste, he is most certainly a pattern of economy. 'Two millions,' it must be confessed, has a most awful and startling sound upon such an occasion, but of the plurality of millions which leak out by perpetual droppings and drippings no account is taken. Could we but see the sum total of what has been squandered away at different times on paltry knick-nacks and ephemeral gewgaws,—on Kew Palaces and Carlton Houses,—on fêtes, fireworks and other solemn tomfooleries, we should stand both aghast and abashed. But even were it doubled, that tremendous sum would not have been expended in vain, if it had purchased us a knowledge of true economy and wisdom for the future. Unfortunately, we seem to have very wrong-headed notions of economy, generally contriving to be at once shabbily penurious and recklessly extravagant in our public undertakings. As regards private economy we are not always very much wiser. However I will not go into that subject, further than to illustrate my text by the following short dialogue between two young men whose allowances were nearly the same. 'I cannot for the life of me, understand,' said one, 'how you possibly contrive to buy so many splendid publications, prints and pictures, I'm sure I can find money for nothing of the kind.'—'So I suppose,' replied the other, 'but then, my dear fellow, you have the satisfaction of knowing that you spend quite as much or more, on cambric handkerchiefs and kid gloves.'—Ah Johnny Bull, Johnny Bull, it is the cambric handkerchiefs and kid gloves,—the expensive fripperies of the day and the hour, that run away with your cash, and leave you none to patronize and advance art. Wastefully profuse in trifles, you generally show yourself exceedingly stingy where extravagance would be rather a virtue than a fault; or else you suffer yourself to be egregiously taken in under the idea of getting 'a capital bargain!' And it is fortunate if your bargains do not make you the laughing-stock of all Europe.—I declare I am growing quite patriotic!

V. Continuing the subject, it may be observed that our merchants do not emulate those of Florence and other Italian cities during their palmy state, in the encouragement of architecture and its sister arts. Is it because they cannot afford to erect noble palazzi and stately mansions?—And yet there are many among them to whom the price of such an edifice as the Reform Clubhouse would be a mere bagatelle. Some of them may be extravagant enough, but there is nothing magnificent in their extravagance. The money goes, perhaps, fast enough, but it goes vulgarly,—in eating and drinking,—in giving expensive entertainments to people who will *condescend* to be seen at them, pinching their pride for the sake of filling their bellies with the luxuries of a citizen's table. Or else the money does not go at all, except that it is let to go on accumulating until some '*beau matin*,' as the French say, the newspapers inform us that Mr. Snobbs or some other indefatigable money-grubber, like the Shoemaker of Bishopsgate

Street, is just dead, and has left property to the value of nearly one million sterling: *sic transit gloria mundi.*—I declare that I am getting quite edifying.

THE PALLADIAN SCHOOL OF ARCHITECTS.

Associated with the Palladian architects, is a name deservingly worthy of mention, for it is that of Kent. The taste of this ingenious artist, found, as it is, in the English mansion and in the palaces of the great, charms us at first by its luxuriance, and then lends us to closer inspection, from a certain correctness of feeling aptly displayed. His claim to this fellowship with the Palladian school rests upon the felicitous manner in which he caught its sentiment, and the rich and varied assistance he threw into the Palladian structure. Confining his efforts more to fancy than to skill, subduing his proportions more for the eye than for utility, he comes before us as the artist rather than as the architect, lavishing his exuberant ideas upon an interior, and unfettered by the many annoyances to taste which the calculating architect feels. There is an air of poetry in his conceptions admirably adapted to soften and to please; forms of carelessness and ease crowd around to soothe the wealthy inmate; there are the gleanings from nature appreciated by all, and there classic forms and allusions appear to enchant the refined.

Kent was one of a class who are lovers of antiquity, and over whose minds its wonderful creations act like a charm, and in whose hearts its beauties feed a passion. We find such painting the sky and peopling it with angels; throwing upon the walls figures of elegance, quaintness or dignity; carrying the whole harmony of a design into the saloon or gallery, and scattering it amidst an assemblage of forms without perplexing any: making the design to appear conspicuous and happy, even when associated with the noble, free, and graceful outlines of the sculpture.

I have placed Kent thus soon in the list of the artists of his school, from the necessity there appears to be to introduce to the notice of the influential, men of his particular stamp of genius. Not so much to criticise the excellencies of design, as to hint at the talents of many, gifted as he was, who are forgotten or despised, in the rush after foreigners. It would be well for the sapient, spectacled virtuosi (who sniff talent from the south long before the genius of their choice is born), if they would take their cold, starch, accommodating fancy into some of the mansions graced by his free yet careful hand. Why do the fraternity hesitate to patronize native genius? Why do these gentlemen, whose very fancy comes, like mushrooms, out of impurity, turn their squeamish patronage elsewhere? There must be some miserable prejudice afloat in the world of art, arising out of pedantry, and inflated efforts after imitation, to account for this. It must be that certain cold natures turn southward, or abroad, conscious of their own frigidity and death-like fancy; but it is not that there is no genius, native to all that is beautiful and fair, that these ghost-like Mecænases hurry about, like unquiet spirits, for their favourite.

Oh, when shall this age of precedent form a school of its own? when shall architecture and her sister arts be found linked in the embrace of nature, when shall Englishmen incite their countrymen to zeal, and art glow with the colouring of health and truth? It is no mean and trivial thing to design an interior. The very consciousness of entire freedom, leads a poor artist into profuseness, and if he seeks a relief by subduing a part, the meagre and shallow forms that appear attest his poverty of mind. The aim in the interior is opposed in every sense to the exterior, at which the passer by is to be arrested, and from which he is to judge of the pomp or dignity of the inmate. In the interior, the *pleasure* of the inmate has to be sought, and the artist has to borrow from the treasury of his fancy, every device which can divert and tranquilize. Through the contemplation of these the mind must unbend and relax into tranquil pleasure. How rich, then, and varied in its conceits, how sensitive in its structure, how refined and delicate, how acute in its parts, must be that mind which can conceive and execute a design so potent in its effects. It is not mere imagination, it is more; it is the imagination cooled and schooled, training its active and perpetual creations according to principle and rule, until it form a picture faithful and real, the original materials of which are in nature. It is not mere fancy either which admires the production, it is rather the fancy compelled by a skilful adaptation from nature of proportion, harmony, and grace, and which is, in truth, the mind affected under a *familiar* not an *artificial* influence.

Hence those artists who sport with flowers, and who fling, with a seemingly careless hand, into design the lighter beauties of their art, deserve attention, and deserve too, the same protection, assistance, and name, as Kent received; but whose talents must droop and wither so long as art holds in her body those worms that gnaw away her sickly vitals.

May 10. FREDERICK EAST.

ARCHITECTURAL ROOM, ROYAL ACADEMY.

WE will dispense with further animadversions on the accommodation afforded to, or rather, withheld from, this department of the Academy's annual exhibitions; not because the slightest improvement in that respect has taken place—not because there is no longer any occasion for the observations we have already made at different times, but because they may be repeated 'till farther notice,' as the playbills say,—that is, to the end of the chapter, and until the Royal Academy, painters, architects, and all shall have become *Fuimus Troes*.—And truly, if architects themselves generally, and the Professor of Architecture in particular, can patiently tolerate a system which produces to them an annual insult, we do not see why we should allow ourselves to be at all ruffled and put out of temper by it. Patience and long suffering are no doubt virtues, and accordingly, as far as the Academy is concerned, architects show themselves the most virtuous of the human race;—not but that there are bounds even to patience, and if pushed beyond them, the illnatured world are apt to call it sheer dullness and stupidity.

In regard to the actual contents of the Architectural Room this season, we regret to find so very few designs for buildings of any promise or importance, among those either in actual progress, or definitively determined upon. We see many competition drawings, but then they are for the most part only rejected ones, while those which are adopted are kept back. For the Assize Courts at Liverpool, there are no fewer than ten different designs—some of them rather indifferent ones—including the successful one by Mr. Elmes, jun. But all of them are now, it seems, set aside, it being now intended to comprise the Courts and the St. George's Hall in one building. We will, however, first pay our respects to the Professor of Architecture, who modestly contents himself with exhibiting a single drawing, and that of a rejected design,—viz. No. 993, described in the catalogue as "A Study for a Front of a Public Building," which turns out to be neither more nor less than his design for the West Front of the Royal Exchange, engravings of which were published some few months ago in the Westminster Review. It certainly is not deficient in richness, and has the merit of avoiding that now common-place feature, a portico treated without any kind of originality, and brought in for the nonce, whether there be any thing else to agree with it or not. Still, it appears to us, keeping has not been sufficiently attended to, there being a disproportion between the large parasite columns and the rest, for not only do they overpower some of the other parts, but actually squeeze them up and encumber the façade unnecessarily and unmeaningly. It further strikes us as singular that Mr. Cockerell should not have exhibited his model for the same building also, as, besides that it would have been a striking object in the room, and would have explained the whole design, we have heard it spoken of as abounding with many effective parts. Still even if he chose to withhold that, we think he might very well have permitted us to see the designs of some other buildings either in progress or about to be begun by him, for instance the New Libraries at Cambridge, the Sun Fire Office at the corner of Bartholomew Lane, and the Taylor and Randolph Institute, at Oxford. Not having chosen to do so, he has no right to be very much astonished should some persons draw unfavourable inferences from it, and impute it to something like a consciousness on his part that none of those designs are calculated to raise his professional reputation.

Like Cockerell, Mr. Barry exhibits only one design, yet that one is altogether new as to subject, and of considerable importance. We were aware that Mr. B. had been commissioned by Lord Francis Egerton to prepare a design for Bridgewater House, but hardly expected to be gratified with sight of it so early. With regard to the subject itself, it will not detract from his high reputation; at the same time we question whether it will add to, or we should say, will raise it very much, since an edifice of such a character and upon such a scale must of course extend its author's celebrity. Grandeur and stateliness it certainly possesses;—and that is something, or rather a very great deal, considering how very rarely we obtain those qualities or any thing like them in structures where we might reasonably expect to find them, and from which they certainly have not been excluded by severe economy,—for instance, the unfortunate and deplorable *à la* Regent Street Buckingham Palace. Bridgewater House is noble and princely in aspect, which is what cannot possibly be affirmed of those two ducal mansions, Stafford House, and Wellington or Apsley

House, which last is so remarkable for nothing as for its smugness and spruceness, for its utter want of dignity, and downright insignificance of manner. Still though there is a fine architectural feeling pervading the whole of Mr. Barry's design, we cannot say that it is marked by originality, notwithstanding that a mansion of such a character will in itself be quite a novelty in the metropolis. It will be a large, oblong and insulated pile of building, two sides of which are shown in the drawing (No. 981), viz., the South and West, the latter facing the Green Park. Judging from what we see, we presume that the same architectural character will be kept up throughout the whole of the exterior, and that the North side will be the principal entrance front, there being there a square tower carried up a story higher than the rest of the edifice, from which we conjecture that the lower part of it will form a carriage porch. The summit of this tower shows itself picturesquely in the view above the general mass of the mansion, and is, no doubt, intended to serve as a sort of belvedere,—an appendage certainly uncommon, but in this instance justified by the locality, in the immediate vicinity of the Parks. We may describe the design generally—at least what is here shown of it, by saying that it consists of a rusticated basement or ground floor, with a continuous Corinthian order, comprising a principal floor and mezzanine; the whole surmounted by a balustrade and vases of globular form. Both the elevations which are shown are perfectly similar in design, except that the South front, which has fifteen intercolumns, consequently so many windows on each floor, has pilasters, while the West front or end towards the park, has three-quarter columns, and six intercolumns less, or only nine windows on a floor. In both elevations, all the windows of the principal floor have triangular pediments, and the mezzanine ones keystones to their architraves. The angles of the building are strengthened by coupled pilasters, so that two adjoining ones exhibit a group of three of them. It should further be remarked that the superstructure is in some degree rusticated as well as the basement, the jointings of the stone being shown on the surface of the walls between the columns, &c. This must suffice in the way of description,—which however exact, can merely enumerate the several items of a design, without exhibiting their aggregate effect; and the particulars we have noticed will serve as an outline of this composition of Mr. Barry's. The size of the building may be tolerably well guessed at, for the Park front may be taken as very nearly the same as that of the Reform Club-house, each having nine windows in breadth, and the proportions of the openings and spaces between them appearing nearly the same in each case. At any rate the difference cannot be much either way, consequently the South front of Bridgewater House, will be to that of the Reform Club as 15 to 9; or we may compute its extent at 190 feet, more or less.

It will be said—we have, in fact, said as much already ourselves, that there is nothing very striking either in the individual portions of this design, or in their combination:—it is nothing more than an excellent application of a good Italian style—absolutely nothing more. But then there is this difference, and a most prodigious one it is, between Mr. Barry's imitations and those of many others—see for instance a lately built façade in Regent Street,—that he generally refines and ennobles the style, and gives us its true sentiment, while they, more frequently than not, absolutely vulgarize it, and render it poor and insipid. If Mr. Barry's principle of composition is no secret to them, why do they abstain from making use of it themselves? It is true, not every one has the same opportunities afforded him, but even those who have favourable opportunities do not turn them to the best account—often throw them quite away, giving us the crassest architectural crudities. We own that Barry has here had a most noble opportunity put in his way; and should the design be strictly followed out—at any rate not impaired by being *pared* down, we may safely predict that it will prove a splendid addition to our metropolitan architecture; and we further trust will be an example forming an epoch in it, by stimulating others of the nobility to imitate such precedent:—whereas hitherto there has been some sort of excuse for their choosing to keep their houses as plain and as homespun in appearance as possible, lest while seeking gala suits for them, they should be imposed upon by such rascally Monmouth-street finery as that in which the Regent Park terraces, and other similar accumulations of architectural Brummagen, tawdriness and vulgarity, are bedizened out, till they almost look like so many regiments of ginshops.

We must pull up and rein in our Pegasus, for we are now got we know not where,—among Charles Barry's antipodes,—the ultra-cockneyfications of people who build by wholesale,—how unlucky that they do not also build for exportation only!—Quiet! Pegasus, quiet! dont kick. We notice some monstrosities of the kind on the walls of the Academy—as when do we not. Nevertheless we will not notice them further at present; therefore give them a chance of escape.

Instead of proceeding methodically, according to the order of the catalogue, we plunge *in medias res*, and turn to No. 1006, Mr. H. L. Elmes' Design for St. George's Hall, Liverpool, which certainly satisfies us much better than did any of the drawings for the same subject, exhibited last year. To say the truth, it is much superior to the general run of our Anglo-Grecian architecture, in which there is nothing Grecian except the columns alone, while here there is some taste, and some study shown as to the other parts. The solid, but ornamental stylobate, enriched with a narrow panel with figures in relief, is good and effective, and some play is produced by the entrances being made separate compositions at the extremity of this stylobate; but we do not understand why instead of being continued throughout, the panel should be divided into two by a blank space forming a break in the centre of the stylobate. The order is a fluted Ionic, forming an advanced colonnade of thirteen intercolumns, containing as many windows, which besides exhibiting considerable novelty as to the pattern of their glazing, are more than usually decorated, and have cornices of peculiar design, crowned by a central ornament—a novelty that deserves to be encouraged, though the form itself might be improved upon. The cornice of the order is also better, because less meagre and insipid than usual, and possessing some degree of embellishment. Thus far we can conscientiously commend—and though it may stand for nothing, our commendation means something; but we must also qualify our praise by some objections, one of which is that the colonnade appears so shallow, as to be little more than an ornamental range of columns placed before the building, nor does there seem to be any entrance to it from the interior. Neither do we at all approve of a colonnade of this kind being made prostyle or jutting out from the building, as if it were a portico forming the approach to it; because it looks too much like a mere useless addition to it, nor is that effect of shadow obtained which is produced by recessing the space behind the columns within the building. However from a perspective elevation alone it is impossible for us to judge very accurately in regard to such circumstances. His other design, for the Law Courts, turns out much better than we expected, for when we first heard that its chief feature was a Grecian Doric portico, we were apprehensive that it would prove merely one of those ultra-Grecian affairs concocted according to recipe à la Stuart, in short some such *regularly* classical piece of design as the New Liverpool Custom-house. We were therefore agreeably surprised at finding it so very much better, and with more than usual taste as to composition, and study as to detail, in which last respect there is one rather happy novelty in the mode—not easy to be plainly described—in which the podium and its mouldings follows the curve of the columns, and form what may be considered either continuations of their shafts, or distinct pedestals, by the podium itself being omitted in the intercolumns beneath the pediment. The general design may be described as consisting of five compartments, viz., a narrow one at each end between antæ, and three others making altogether seventeen open intercolumns, five of which form the slightly advanced central division beneath the pediment; consequently the arrangement of the whole façade bears so far considerable resemblance to that of the Fitzwilliam Museum, at Cambridge. The whole is raised on a low stylobate, and the ascent to the portico is tastefully managed. The pediment is filled with bas-relief.*

Good as the preceding design is, there is far more of originality, both as to conception and treatment, in No. 998, (E. B. Lamb,) for the same building, described in the catalogue as being in an Italo-Grecian style, to which designation it answers sufficiently correctly, being for the most part Grecian in its physiognomy,—in the regularity and richness of its columniation,—but relieved from Grecian monotony by some judicious modifications, and by some application of Italian features. Leaving others to settle whether such style would best be turned Grecian *Italianized*, or Italian *Grecianized*, we will examine the merits of the design itself. The order which is Ionic, is raised upon a somewhat lofty stylobate, or rather, basement floor, and is carried uninterruptedly throughout the whole façade, so as to form an open colonnade of 15 intercolumns, and a closed compartment at each extremity between bold coupled antæ. This last circumstance gives additional value to the rest,—for those parts contribute materially to breadth and repose, while they are far more important in themselves than had there been merely two antæ and the space of an intercolumn between them. At the same time that greater contrast is thus obtained, a pleasing degree of uniformity has also been kept up, and this has been accomplished in a manner as effective and tasteful as it is novel, viz., by recessing the upper part of the wall between the antæ, so

* We have been informed that this design is almost identically the same with that by Barry for the Law Courts, proposed to be erected in Lincoln's Inn Fields. We greatly doubt, however, if such be the case, except, as far as the general arrangement goes; for if the peculiarity above pointed out, with regard to the columns, be the same in both instances, it would be a very remarkable coincidence indeed.

as to admit of a large statue being there placed at each end, and which of course becomes strongly relieved by the mass of shadow surrounding it. This may so far not be Grecian, because there is no direct authority for it, but then it is on that account all the more meritorious, because it is most certainly, both Grecian and classical, in sentiment. Similar in character to the parts just described, but with some variations, owing to their being more extended, are the elevations of the ends of the building, so that the whole is in keeping throughout; which we are sorry to observe is a much greater and rarer merit than it ought to be,—certainly one that has been utterly disregarded by the classical architect of the Post Office. Among other points that particularly recommend this design of Mr. L.'s, is that he has kept up or rather enhanced the dignity of the colonnade, in the first place by introducing inner columns in the part serving as a vestibule between the two courts, and in the next by avoiding windows, and making the two doors seen behind the columns very conspicuous and highly ornamental features. There is also much that is equally good and new in the details of the order itself,—in the capitals especially, and likewise in the cornice.

(To be continued.)

ENGINEERING WORKS OF THE ANCIENTS, No. 5.

Thucydides, who wrote about the year 400 B.C., is the next whom we shall take in our discursive course; his history however presents few gleanings.

WALLS OF ATHENS.

About 481 B.C., the Athenians restored their dismantled walls, and also enclosed the Piræus.* From political circumstances the works were very much hurried, the foundations were laid with stones of all sorts and sizes, some unwrought, and just as they were brought up by the servers. Many pillars too from sepulchral monuments, and other wrought stones were worked up in the building; for the boundary wall of the city was now far greater, being in every direction carried out; and for this reason it was that they urged on the work, employing alike whatever came to hand. It was Themistocles, too, who persuaded them to build the remaining walls of the Piræus (for this had been begun by him during the year of the archonship which he filled at Athens), thinking the place highly favourable, as having three natural ports, and that as they had become a nautical people, it would much contribute to their obtaining naval power. Indeed he first ventured to tell them they should apply to the sea, and then immediately assisted them in acquiring the empire of it. By his counsel it was that they built the wall of that thickness about Piræus; for two wains brought stone, passing by each other upon it, and going contrary ways. Within, there was neither rubble nor clay, but the stones were large and hewn square, fitted together in building; and those on the outside bound together with stone and lead. The height however was only finished to about the half what was designed, for his intention was to effectually repel all hostile attacks, both by the thickness and the loftiness of the walls, and he thought that thus a few, and those the least effective persons, would be sufficient to man it, and that the rest might embark on board the fleet: for he chiefly devoted his attention to the shipping, perceiving, it seems, that there was a readier access for the king's (Persia's) forces against them by sea than by land. For he judged that the Piræus would be more serviceable than the upper city, and often counselled the Athenians that if ever they should be foiled by land, they should descend thereto, and with the navy make head against all opponents.

Frequent mention is made in other places of walls of defence and offence, but these do not present sufficient general interest to call for particular notice.

The Athenians, as we shall hereafter have occasion to mention were distinguished as engineers, and particularly skilful in constructions of this kind. On account of the peculiar mode of building, workmen were employed who were skilled in this iron cramping.† Thus we find that to the seige of Nisæa were sent iron and stone-masons.

MINES.

Although Thucydides was himself a proprietor of mines, we find very few and short notices in his work. In the First Book chapter 100, allusion is made to a mine in Thrace, of which mention is made by no other author. In the Second Book, chapter 55, our author recounts that the Peloponnesians, having devastated the champaign country of Athens, passed into what is called the territory of Paralus, as far as Laurium, where were the Athenian silver mines, to which however they appear to have done no injury. The gold mines near Thrace were possessed by Thucydides,* and are supposed by the commentators to have been situated at Mount Pangæus, and to have been the same from which Philip, King of Macedon, derived the funds which enabled him to conquer Greece.

ATHENIAN ENGINEERS.

The reputation of the Athenians as engineers is attested by Thucydides in the following passage.† The Lacedemonians as their war against the rebels in Ithome ran out into a length of time, demanded the assistance of the allies, and amongst others of the Athenians. No small number of these were sent to their aid under the command of Cymon. The demand of assistance from them was principally owing to the reputation they then were in for their superior skill in the methods of approaching and attacking walls.

VALUE OF WROUGHT MATERIALS.

Another of those circumstances which attest the value of manual labour among the Greeks, we find in the Second Book, in the account of the preparations made by the Athenians for sustaining a siege during the Peloponnesian war, when they removed into the city not only their moveable property, but even much of the woodwork of their houses.

CONDUIT AT ATHENS.

Thucydides (Book Second), mentions at Athens a conduit called the Enneakrounos or Nine Pipe, from the manner in which it was embellished by the tyrants, formerly called Callirhoe.

SIEGES.

The sieges described in this history do not well come within our sphere, but those who are desirous of ascertaining the resources of Greek military engineering, will do well to refer to them, particularly to the siege of Platea. Here we find mining, countermining, raising mounds, walls of circumvallation, &c.

BRIDGE OVER THE STRYMON.

In the Eighth Book we find the bridge over the Strymon, mentioned by other authors referred to.

Persians.

DIVERTING RIVERS.

We find in Thucydides one solitary mention of the Persians, and that with regard to the art in which they excelled, hydraulic engineering. Megabyzus, the son of Zepyrus, commanding the Persian forces in Egypt, having driven the Greeks out of Memphis, drove them into the isle of Prosopis, where he shut them up. Here he kept them blocked up for a year and six months; till having drained the channel, by turning the water into a different course; he stranded all their ships, and rendered the island almost continent. He then marched his troops across, and took the place by a land assault.

Diodorus the Sicilian, was the author of a general history called the Historical Library; he flourished in the first century before the Christian era. The first of our gleanings from the translation of his work by Booth, relates to the Egyptians, who are treated of in the First Book.

Egyptians.

HONOURS PAID TO ENGINEERING.

All writers in Egypt attest the honour in which the Egyptians held the construction of public works, many of their oldest monuments being attributed to the gods. The god Osiris, by some is named as the founder of Thebes, and he made an expedition through the world for the purpose of introducing civilization, during which he built several stately cities, particularly in Ethiopia and India. In enumerating the merits of the kings, our author says, "And besides all this, were conquerors of many nations, and grew exceeding rich, and their provinces were beautified with many stately magnificent works, and their cities adorned with many rich gifts of all sorts."

EMBANKMENT OF THE NILE.—HERCULES AND OSIRIS ENGINEERS.

In the time of Osiris, the Nile is reported to have broken its banks, and overflowed the greater part of Egypt. On this occasion the old or Egyptian Hercules, who, says our author, was always for old and difficult enterprises, and ever of a stout spirit, presently made up the breaches, turned the river into its channel, and kept it within its ancient banks; and therefore some of the Greek poets, from this fact, forged a fable, that Hercules killed the eagle that fed upon the heart of

* Book 1, ch. 93. † Book 4, ch. 69.

* Book 4, ch. 106. † Book 1, ch. 11.

Prometheus. The most ancient name of the river was Oceames, which in the Greek pronunciation was Oceanus, afterwards called Eagle, upon the violent eruption which covered a great part of the province governed by Prometheus, in consequence of which he died of grief.

What Hercules did for the lower part of the Nile, Osiris did for the upper part of the same river, for having come to the borders of Ethiopia, he raised high banks on either side of the river, lest in the time of its inundation it should overflow the country more than was convenient, and make it marsh and boggy; and made floodgates to let in the water by degrees as was necessary.

Uchoreus, whom Diodorus calls the builder of Memphis, thus managed the site he had chosen. The Nile flowing round the city, and at the time of the inundation covering all round on the south side, he cast up a mighty rampart of earth, both for a defence to the city against the raging of the river, and as a bulwark against an enemy by land; on every side likewise he dug a broad and deep trench, which received the violent surges of the river, and filled every place round the rampart with water, which fortified the city to admiration.

We here find Osiris, the chief god of the Egyptians, and Hercules enrolled among the patrons of engineering, so that when the profession is driven to a pinch for an emblem, here is the *deus ex machinâ*. Hercules destroying the eagle preying on the vitals of Prometheus, will make a pretty device either on a medal or on a service of plate presented to a member of the profession.

EMBANKMENTS OF SESOSTRIS.

Sesostris on his return from his warlike expeditions applied himself like his predecessors to the adornment of his country. Among his other labours are mentioned that he raised many mounds and banks of earth, to which he removed all the cities that lay low and in the plain.

CANAL OF THE RED SEA.

The following is the account which our author gives of the famous canal of the Red Sea. From Pelusiacum as far as to the Arabian Gulf, and the Red Sea is a canal cut out. Necos, the son of Psameticus, was the first who began this work, and after him Darius the Persian carried it on, but left it unfinished, being told by some that if he cut it through the isthmus all Egypt would be drowned, for that the Red Sea lay higher than Egypt. The last attempt was made by Ptolemy the Second, who cut a sluice across the isthmus in a more convenient place, which he opened, when he had a mind to sail down that way, and then presently after shut up again; which contrivance proved very useful and serviceable. The river which runs through this cut is called Ptolemy, after the name of its maker. Where it falls into the sea, there is a city built called Arsinoe.

According to Diodorus, Nile, King of Egypt, called the river after his own name. For being that he cut many canals and dikes in convenient places, and used his utmost endeavour to make the river more useful and serviceable, it was therefore called Nile.

Sesostris also cut a great many deep dykes, or canals from the river, all along as far from Memphis to the sea, for the ready and quick conveying of corn and other provision and merchandise, by short cuts thither, for the support of trade and commerce, and maintenance of peace and plenty all over the country. These canals served also as defences.

COCHLIA.

Our authors say that the land was watered from the canals by means of a certain engine, invented by Archimedes the Syracusan, and which received its name from its resemblance to a snail's shell.

LAKE OF MERIS AND THE LABYRINTH.

So much distrust has been thrown on the account of the Lake of Meris, that we think it better to refer those of our readers, who are desirous of obtaining information respecting it to the original, rather than give it here.—The same remark we must make with regard to the Labyrinth.

WALL OF SESOSTRIS.

Sesostris is recorded as having built a wall for the defence of the east side of Egypt, against the irruptions of the Syrians and Arabians. This wall is stated to have extended from Pelusium through the deserts as far as Heliopolis, and to have been fifteen hundred furlongs, or about two hundred miles in length.

PYRAMIDS.

The Pyramids and Obelisks are works certainly belonging to engineering, but as it is our object rather to show the bearing which ancient history has upon the practice of the art in modern times, than to elucidate subjects, which more properly belong to the province of the antiquarian, we content ourselves with reminding our readers, that in the author before us they will find much information with regard to these splendid works of art.

GEOMETRY.

The priests were the instructors of youth, and the learning taught by them was called sacred. In arithmetic and geometry, even in the time of our author, they kept the students a long time.

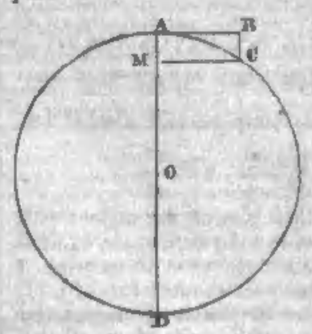
(To be continued.)

ON THE ACTION OF CENTRAL FORCES.

"Happy is the man who can discover the causes of things."

SIR—In the number for April last, there is inserted a paper on central forces, in which the writer endeavours to prove the existence of "an inscrutable law of nature," according to which centrifugal force is excited by the curvilinear motion of a heavy body.

Before offering remarks on that paper, let us first inquire into the distinct action of the forces that retain a heavy body in a circular path.



Taking the usual diagram, let ACD be a circle of revolution, AC any very small part of it, AOD the diameter at the point A, and BM the rectangle on the diagonal AC. Then AM is the effect of central attraction on the body at A, and AB its projectile motion. The motion in AM is accelerative, being originated from nothing by central pressure. The motion in AB is uniform, being the result of an impetus previously communicated. Now the ratio of AM to AB may be diminished to any extent, by diminishing AC. For $AB^2 = AM.MD$, and therefore $AB : MD :: AM : AB$. Now, in reducing AC we reduce AB also, and the less we make AB, the less is its ratio to MD or AD, and the less also is the ratio of AM to AB; and this ratio may thus be diminished to any extent. Thus, also, the circular motion may be considered ultimately, when AB becomes indefinitely small, to be composed of projectile motion and incessant central pressure. Again, $AC^2 = AD.AM$, and $AB^2 = DM.AM$, therefore $AC^2 - AB^2 = AM.(AD - DM) = AM^2$. But it appears that this difference may ultimately be neglected: therefore $AB = AC$ ultimately. But AC will be the momentary projectile motion of the body when arrived at C, and therefore, as the other circumstances of motion are the same as at point A the new resultant and consequently, also the new projectile motion $= AC = AB$. This proof holds good at every other point, and therefore the motion in the circle must be uniform, and equal to the original projectile motion.

To proceed; the writer begins with a familiar example of rotatory motion in the operation of electro-magnetic attraction upon a projected bar of iron. He says that its motion in the circle is uniform, because the deflecting and projectile forces do not influence one another, being independent of each other, and acting at right angles. Now, certainly they are independent as to origin, for the bar would adhere to the magnet, though it moved not at all. But the deflecting force is dependent in respect of *quantity* upon the other. We cannot certainly say that the whole power of attraction is deflecting force, though the writer says so expressly in another part of his paper, page 115. On this supposition we might make the deflecting force as strong as we please, other circumstances being identical; which is absurd, and would, if true, overturn entirely our mathematical demonstrations on the subject, including propositions of which he himself makes use. In fact, magnetic attraction may be much greater than is necessary for that purpose. The deflecting force, then, strictly so called, is just so much of the attractive force as is necessary for deflection, the overplus being superfluous pressure. Respecting their action at right angles, I have already shown, that the deflecting force greatly influences the projectile. In fact it perpetually combines with it, and produces resultants equal to one another, and to the projectile motion. *This* is the reason of the constancy of circular motion.*

Mystifying the origin of centrifugal force, he says that as it is equal and opposite to the centripetal force, it cannot arise from the magnetic

* He says again, the centrifugal force cannot be the resultant of the other two forces, for it would then point within the circle. This contradicts the very definition of circular motion, which is that the resultant is neither within nor without, but *in* the circle.

action. Certainly not from the overplus action, but undoubtedly from the deflecting magnetic action, for it is evidently just a case of the third law of motion; that action and reaction are equal and contrary: a very satisfactory explanation, yet what an effort is made to obscure the subject!*

The writer now drives the apparatus with a winch, and supposes the magnetic attraction to perform the business of cohesion, and then asks if his hand imparts the centrifugal force. This requires no answer from me, and he has thought fit not to do so either.

His illustration in the case of a sling, I confess I understand not. It involves the absurdity of expressing velocity in terms of weight; although, as I understand it, it ought to be told in terms of space and time.

The instance of the fly-wheel has little new, except the manifestation of another misconception of the writer's. "The central (centrifugal) force, says he, acts by pressure, and a resultant from that pressure and the force in the circle is the consequence, but so long as resistance from cohesion continues, neither motion nor pressure can be imparted to another body by the central force." The writer here exchanges cause and effect, for he would fain attribute a self-exciting property to the centrifugal force, and insinuates accordingly that the resistance of cohesion is the *consequent* centripetal force. Whereas the reverse is the case; the cohesion is exerted, because it perpetually winds the direction of projectile motion; and the centrifugal force is plainly the *inertictic* (forgive the innovation) tendency of the body to rectilinear motion. There is also something said of moment of rotation, irrelevant to the subject.

The experiment of the whirling table simply confirms what was proved long ago, that, using the writer's symbols, $x = \frac{v^2}{r}$.

After recapitulation, he concludes the first part of the subject with the notable inference, that centrifugal force is a physical agent, excited by an inscrutable law of nature when matter moves curvilinearly. I need not say how unnecessarily this law has been brought forward. It really would be more surprising than the formation of magnets by electric operations. For electricity and magnetism are identical, and therefore naturally enough such a result should take place. Though we may not know the absolute nature of physical principles, we may accurately know their relative nature. Therefore the writer is unfortunate in his allusion, as we are dealing in relatives, not in absolutes.

Proceed we to the second part of the subject: the composition of the projectile and centrifugal forces. And here an absurdity at once presents itself. We are told that a ball weighing 1 lb. moving in a circle of 2 feet radius, at the rate of two revolutions per second, has a projectile velocity of 25·14 per second, and a centrifugal velocity of 157·76 per second. This number has evidently been the result of the formula $\frac{v^2}{2r}$, which expresses the proposition quoted from Brewster's Encyclopedia. For $\frac{25{\cdot}14^2}{4} = 157{\cdot}76$ feet. Now, it is a misnomer to call this the velocity per second. It is the space passed through in a second by the body, with a motion accelerated from nothing. We might as well say that $\frac{157{\cdot}76}{2} = 78{\cdot}88$ feet would be the space passed through per half second. But what would the rule give us? The projectile velocity per half second being 12·57, we would have by the rule $\frac{v^2}{2r} = \frac{12{\cdot}57^2}{4} = 39{\cdot}44$ feet per half second: ludicrously inconsistent. The writer places the two forces on the same footing, whereas the one is impulse, the other pressure; which renders the succeeding reasoning a baseless fabric. I have shown at the commencement of this paper, which I fear is too long, that the shorter the time supposed for action, the less is the ratio of the effects of the projectile and centripetal forces, and therefore in any moment of time, the effect of the latter is unassignably less than that of the former. If he will turn also to Cavallo, whom he has so often quoted, he will find the same conclusion come to in his third proposition on curvilinear motion.

The experiment with the tube and balls, though it has the appearance of accuracy, is undoubtedly pointless. The apparatus must have been exceedingly clumsy to require "very high increasing velocities" to manifest the action of this wonderful power.

"As to the probable results of a practical application of this principle," they will be exactly nothing at all, as the experiment with the tube and balls well nigh proves.

I am, Sir, your obedient servant,

DANIEL CLARK.

Phœnix Iron Works,
Glasgow, May 10, 1841.

* The idea of the perpendicularity of their directions preventing their mutual action is very absurd. What is parabolic motion?

ON THE EMPLOYMENT OF MILITARY ENGINEERS.

SIR—In your last month's Journal, under the above head, I find an attack made on military engineers and military engineering, as uncalled for and unprovoked, as it is narrow-minded, illiberal, and ungentlemanly, and I am sure that from a sense of justice you will insert these few remarks in reply to the anonymous libeller who signs himself "Civilian."

The purport of the writer is an evident desire of venting his petty spleen on a body of talented, high-minded, and honourable men, and whilst I much regret that your columns have been made use of for the purpose of libelling a "Captain of engineers at the head of the architectural and engineering departments of the Admiralty," viz. Captain Brandreth—a gentleman whose talents, urbanity and kindness have endeared him and made him respected by all who have been connected with him in his professional capacity—I am sure that no civil engineer laying the slightest claim to station, to gentlemanly feeling, or to respectability, would ever descend to such low personalities, nor will "Civilian" ever obtain the sanction or countenance of such men to his vituperations.

If "Civilian" had the benefit and the interest of the civil engineer at heart, he would never for a moment wish to weaken the union which is now daily increasing between the civil and the military engineer, for their mutual as well as for the public good. The spheres of action of the two professions lie in almost every case so widely apart that they may be said never to clash; while the foreign services of the military engineer open to him a vast field of inquiry and information, which those who practice in this country as civilians are unable to obtain. His varied information, his experience, strength of mind, and coolness for calculation, fully entitle him to such offices as the country is able to give; and in *justly* awarding the few she does to him, she but acts for her own interest.

With respect to young gentlemen who are educated at the military colleges—is "Civilian" aware of the rigid examination these gentlemen have to pass through before they are entered into the corps of engineers? and that but a very small number are admitted into *that* corps every year? Is he also aware of the number of young gentlemen who are annually sent out of engineers' offices, after spending, as "Civilian" boasts, "nearly £1000," is he aware that *they* are sent out without *any examination*, and in most cases with a meagre knowledge picked up in the best way they are able, and not "drilled under the auspices of their colonel"—would they had been! And why, I would ask, are men of talent, of exertion, of experience, not to practice in the varied callings of their profession, if they so please, if they are competent, and if the public will employ them?

I am a civil engineer myself, which fact I doubt of "Civilian," indeed I would not, for the credit and the respectability of the profession, believe he ranked himself as one, as no man holding any station in it, much less having any respect for himself, would be the author of such a production.

I am, Sir,
Your obedient servant,

Bristol. VERITAS.

SLATE CHIMNIES.

SIR—Having lately adopted a plan, by means of which slate slabs may be made use of, in the construction of chimneys or flues, in connexion with an open fire grate, and in situations where the common brick chimneys could not be built, I take the liberty of submitting the plan to your consideration.

Having not long ago taken possession of a house, attached to which was a room built at the side, and not having fire place and chimney I adopted the following plan:—I fixed to one of the walls of the room, at a proper height from the floor, a common open fire-basket or grate, having a strong iron back, not let into the wall, but fixed in front of it. I then had four long narrow slate slabs put together, so as to form a square hollow pillar open at top and bottom, and the pillar so formed I had erected against the wall immediately over the fire-grate, and

carried the pillar out through the ceiling and roof of the room. The fire-grate and flue thus enclosed, had a chimney-piece of slate set to correspond. The slate, not being so good a conductor of heat as iron, does not give out any thing like the same quantity of heat an iron pillar or pipe would have done; at the same time the heated air, passing up through the slate pillar imparts to it such a degree of heat, as adds very perceptibly, and I may add very pleasantly, to the warmth of the room. The Welch slate, as is well known, will crack* on being exposed to a very slight degree of heat, but my slabs were made of Valencia slate (from quarries in Ireland), which do stand heat very well, if cautiously applied in the first instance.

The superficial quantity of slate used was very small, the slabs being very narrow, consequently the expense was very trifling. The economy of heat I consider to be no small advantage in my plan. In the case of a common brick chimney let into the wall, the heated air passes up it, imparting no heat to the room, but in the case of this slate pillar, erected *within* the room, the heated air passing up through it, is conducted by means of the slate into the room. Indeed it was found that the warmth of the room was fully maintained with a very small consumption of fuel.

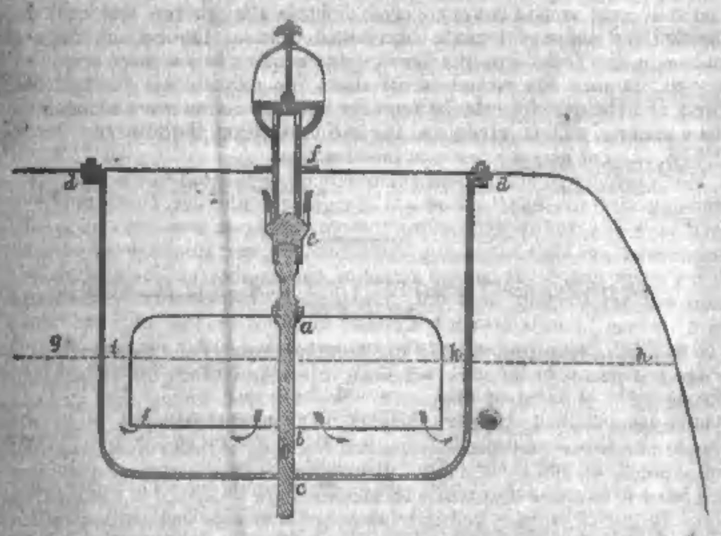
Should you deem this little plan worthy of being brought to the notice of your architectural friends through the medium of your valuable Journal, it will much oblige, Sir,

Your obedient humble servant,

London, May 6. A LOVER OF THE FIRESIDE.

ALARUM WHISTLE FOR STEAM BOILERS.

SIR—The enclosed sketch represents, in section, a simplified form of alarum whistle for steam boilers which has occurred to me. Should you deem it worthy of insertion, you will perhaps give it a place in your valuable pages.



a, i, k, b, is a float, which consists of an inverted vessel of sheet iron or other metal, through the centre of which passes a spindle *a c*, having a collar at *a*, upon which the float is screwed down by a nut outside. At the upper end *e* is fixed a cap of brass with a joint ground steam-tight to the bottom of the whistle *f*; *d c d* is a stay through which the spindle *a c* passes, having sufficient clearance in the hole at *c*. This stay may be either double, as shown, or single. At *b* is a cotter which prevents the spindle dropping farther than the distance from the bottom of the cotter to the stay at *c*; *g h* is the surface of the water.

When the steam is down, the cotter in the spindle rests upon the stay, through which the spindle passes leaving the passage at *e* open. As soon as the steam rises, the vessel *i a k b* fills with steam and rises to the position shown in the sketch. When the water falls the float also falls, leaving the passage to the whistle open, and is stopped in its descent, as above described, by the cotter *b* resting on the stay. There are holes at the sides of the cup *e* as well as a passage through the top to prevent the lodgment of dirt, &c.

The advantage which I think this apparatus possesses above any I have yet seen, is the absence of any working joints, there being only two points of contact required, at *e* and *c*, and those leaving clearance. The whistle will also act as a vacuum valve when the steam goes down; for it is evident that when the steam is below the pressure of the atmosphere, it will be condensed in the float vessel, which will consequently fall by its own gravity.

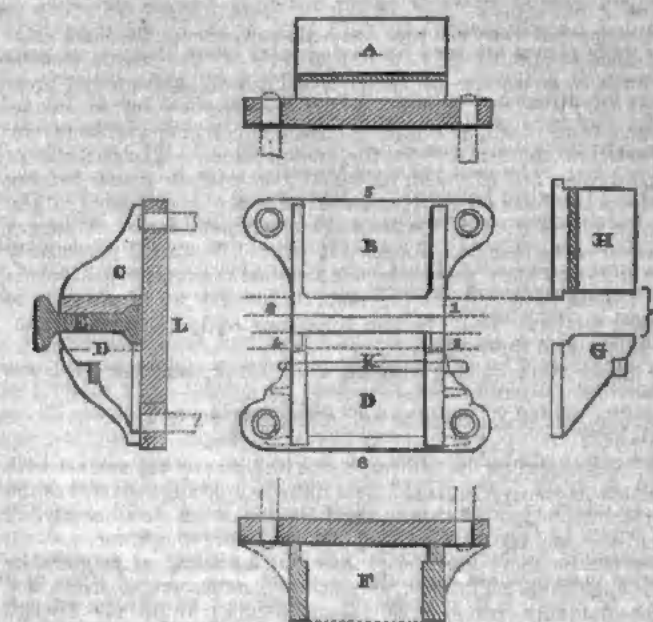
I am, Sir,

Your's obediently,

Liverpool, May 15. G. J. HORNER.

* Some qualities will stand the fire remarkably well.—ED.

NORTH OF ENGLAND RAILWAY CHAIR.



A, section from 1 to 2.—B, plan of chair.—C, section from 5 to 6.—D, ditto, locking cheek in its place.—E, ditto, rail.—F, ditto, from 3 to 4.—G and H, side and end of locking check.—K, malleable iron key or wedge.—L, stone blocks, or wood sleepers.

SIR—I beg to hand you a sketch of a joint chair with some explanation, &c., and a section of the rail used on the Great North of England Railway, which are at your service. The chair is considered to be well adapted to the rail, and simple in its principle. The middle chair, as well as the cheek chairs, are on the same construction, but vary in the weight:

Joint chair	40 lb.
Middle do.	41
Cheek do.	30
Rail per yard lineal	60

The railway has now been opened since the beginning of last April, and keeps in a good working condition, there are very few slips or subsidence in any of the embankments or cuttings. From the easy gradients, solidity of execution, and other favourable features connected with the Great North of England Railway, it readily may be inferred that the line will be worked at less cost than any other line of the same extent.

I am, Sir,

Your obedient servant,

York, May 12. M. Q.

GREENWICH RAILWAY.

List of tenders of the third contract for widening the railway between the London terminus and the Croydon Junction, delivered in on the 27th April last.

Mr. Jackson	£11,608
Messrs. Ward....................	11,802
Mr. Grimsdell....................	11,947
Messrs. Grissell and Peto	12,275
Mr. Bennett	12,350
Messrs. Baker....................	12,380
Messrs. Little....................	12,406
Messrs. Lee....................	13,323
Mr. Mundy....................	13,528
Messrs. Piper....................	13,650

NEW AND USEFUL INVENTIONS.—No. 4.

By Philotechnicos.

PIMLICO SLATE WORKS, UPPER BELGRAVE PLACE.

These works have been lately erected for the purpose of sawing, planing, moulding, and turning slate by machinery worked by steam power, for the manufacture of a great variety of useful and ornamental articles. The slabs are distinguished by their ebon-like appearance and freedom from green spots or stains. They are produced from the proprietor's own quarries in North Wales, where they have extensive machinery worked by water power, and from whence the slabs are forwarded, roughly planed; they are here finished in various ways; the roughly planed are used for paving, wine binns, cisterns, covering, and common purposes, the smoothly planed for sinks, mangers, and shelves for larders and dairies. The snaked or finely rubbed for bettermost purposes of the same description, chimney pieces, hearths, baths, skirting and sideboards, and when oiled have the appearance of black marble. The next and most beautiful state in which the slate slab is used is when japanned; by this process it is subjected to great heat, which leaves on its surface a permanent polish, and is used for decorative purposes as a general substitute for marble or scagliola, and a most excellent substitute it is, being of a hard close texture it bears a sharp arris and brilliant polish, and one of its greatest advantages is cheapness.

Chimney pieces are made to any design, and their manufacture at this establishment forms one of the most useful applications of slate for building purposes; the imitations of conglomerate marbles are matchless, and the correctness with which machinery performs its duty is strikingly exemplified in every part of the work. I sincerely hope this invention will induce architents to introduce marbled slate chimney pieces in every place where the common-looking Portland is now used, to which material it is so superior that there is no comparison with regard to appearance, and is but little more in cost.

Sideboards, tables, cheffoniers, and other articles of furniture are likewise manufactured with the japanned and marbled slate, in the panels of which are occasionally introduced beautifully executed paintings, similar in appearance to those on papier maché. A billiard table has been constructed at this manufactory, the whole of which, frame, bed and legs, is of slate; the legs are massive, and show the capability of slate for purposes of support.

For culinary purposes slate is particularly applicable from its cleanliness, the closeness of its texture preventing the possibility of imbibing any thing offensive, and requires only to be occasionally cleaned with soap and flannel to remove any impurities; it is consequently well adapted for sinks, shelves for larders, meat safes, and dairies, paste or butter slabs, salting vats, and many other purposes where a cool and clean material is required.

In the laundry it is useful for ironing tables, clothes presses, and mangles, the smooth and hard surface of the slate rendering the clothes subjected to its pressure nearly equal in appearance to their having been calendered.

Shops may be elegantly ornamented with slate, both internally and externally. In the shop front a brilliant effect might be produced by its introduction, with the advantage over marble of its retaining the polish after exposure to the weather; for counter tops and fronts and show tables a novel and pleasing effect may be produced, particularly in confectioners' and chemists' shops, taverns, railway refreshment rooms, and other places of public resort.

Stables fitted up with slate will have the advantage of superior cleanliness to any other material, its non-absorbent qualities preventing infection, and its hardness being an antidote to crib biting; the mangers, stalls, linings, and capping can be made of slate, as well as the corn-binn, which latter, being made with a sliding cover, and wholly composed of slate, is most useful, as being cool, cleanly, and proof against vermin.

Fire-proof buildings may be constructed with the greatest facility by the introduction of slate for the floors, skirtings, stairs, doors, and window frames. The drying-rooms, or, as they may be almost termed, the ovens, at this establishment, are composed principally of slate; the floors, shelves, and sliding folding doors, running with rollers upon a railway, and roof, are of slate, and subjected to a high degree of temperature.

I must confess my surprise at often seeing buildings erected for the purpose of warehousing inflammable or other goods with timbered and boarded floors; it is an unpardonable oversight not to take advantage of the various kind of materials suitable to this purpose, adapting the material to its use, and the many calamitous fires that have lately occurred, prove too truly the want of this discrimination. I do not know any thing better than slate to serve this end; light iron joists covered with slate slabs will form an excellent floor or flat, sliding doors can be constructed on rollers, and the stairs made entirely of slate—here then will be a building perfectly fire-proof at but comparatively small cost, and yet how little slate is used for this purpose. I am most anxious to draw the attention of architects and engineers to this particular point, as it is one of their imperative duties, as far as it is compatible, to render any portion of the building they can, fire-proof, substituting slate for wood in every case where such can be done with advantage.

Balcony bottoms, steps, and such works as require lightness and strength, can be constructed of slate, as it is calculated to be five times stronger than stone, and is, when only self-faced, comparatively smooth, or can be moulded and rendered perfectly smooth by machinery where a high finish is required.

Having enumerated several of the many uses to which slate is applicable, I shall conclude with a strong recommendation to the profession to encourage its manufacture as a material entirely of home production, and one capable of much diversity.

[We have received the following communication, showing the strength of the above slate.—Editor.]

Sir—The following trial of the strength of slate in its capacity to resist pressure, may not be altogether uninteresting.

Having occasion to cover a subway of considerable length under a carriage road, and being desirous to use slate on account of its non-porosity, it became necessary to test its strength, and I procured a piece from the Pimlico slate-works about 5 ft. 6 in. long, 5½ in. wide, and nearly 2¼ in. thick, planed fair on both sides. Messrs. Bramah and Wood, of the Grosvenor Iron Works, kindly made the required experiment for me.

The ends of the slip of slate having been placed on supports 5 feet apart, it was loaded in a pyramidal form with ballast iron, the centre loading being about 3 ft. 6 in. high, and the sides from about one foot. When weighted with 1 ton 5 cwt. 3 qrs., the slip broke. I fancied that I could detect a very slight deflection when the last cwt. was added, but although I had a line stretched along the bottom edge of the slip, the deflection was hardly perceptible when it gave way.

Mr. Magnus, the proprietor of the works, thinks this hardly a fair test of what the slate would bear, its strength being much reduced by the planing, which intersects the natural laminæ of the slate.

Torrington Square, Your's, &c.,
May 19. Henry Robert Abraham.

BENEVOLENT INSTITUTION FOR MECHANICAL ENGINEERS.

We have long regretted in the great advance of the profession, that while it possesses so many excellent scientific institutions it possesses none of a benevolent character. We are well aware that attempts have been made to supply this want, and that the principal cause why such efforts have not succeeded is that the want of benevolent assistance has not been sufficiently felt. It would be a libel indeed on the profession to suppose that while its members are so liberal in encouraging the spread of science, and in educating successors and rivals to themselves, that they should from pecuniary motives be neglectful of the material interests of their fellows, that while providing for the mind they should be neglectful of the body. The cause and the only cause has been the one which we have assigned, but we think that it now becomes a matter of grave consideration, whether the same circumstances should still be allowed to have weight. We have reason to believe that as regards the higher branches of the profession, notwithstanding the hundred and fifty candidates the other day for the Chief Engineership of New Zealand, no serious pressure exists, but with the growth of the profession, and on its assuming a settled form we think it is incumbent on us to provide for the future. Further our pride is at stake, for our's is the only profession which is without institutions for the relief of its members, and while we have our universities, our colleges, and our institutes, we have no benevolent society. It may be a matter of gratification that we do not yet want it, but we must not be sure that this will long be the case, or that the *dura pauperies* will be long before it subjects us also to its harsh rule. It must also be borne in mind that if the higher branches do not imperatively require to unite for such a purpose on their own account, there are other classes connected with them the promotion of whose welfare is not less imperative. The workshops are crowded with hundreds of men, who although enjoying high wages, are too frequently from defective education, wasteful and improvident, and here we must pause for a minute